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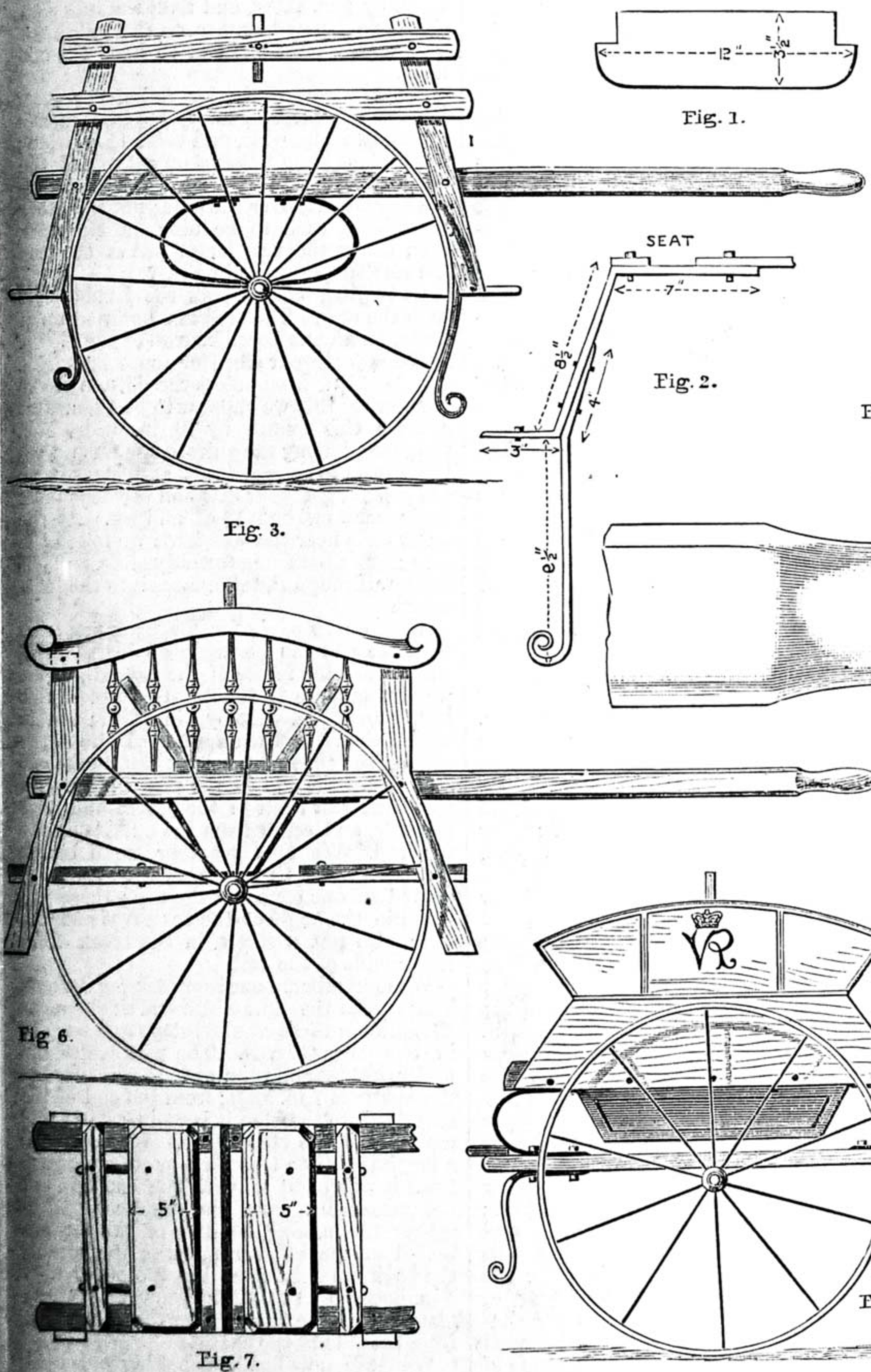
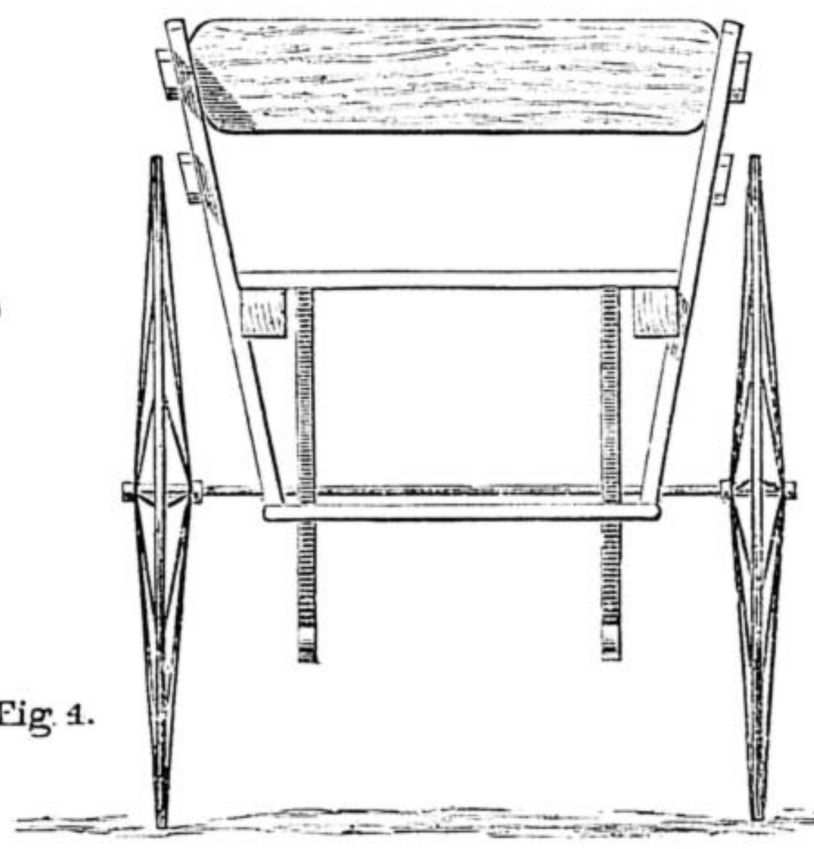


Fig. 1.

Fig. 2.

Fig. 3.



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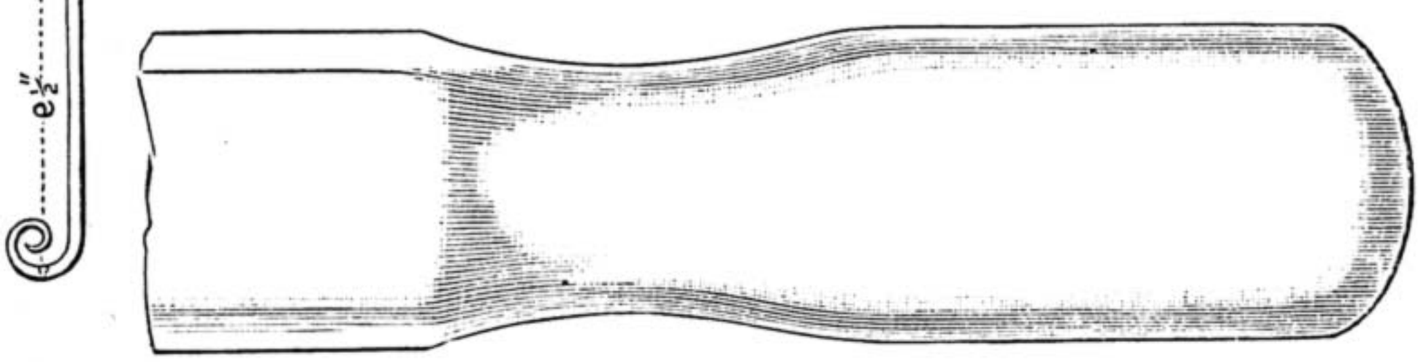

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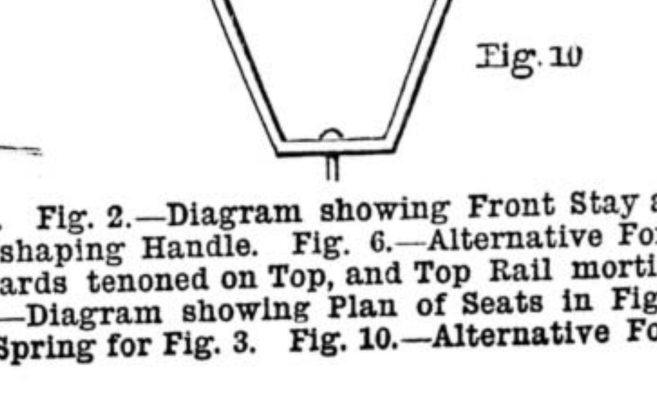

Fig. 9.

Fig. 7.

Fig. 8.

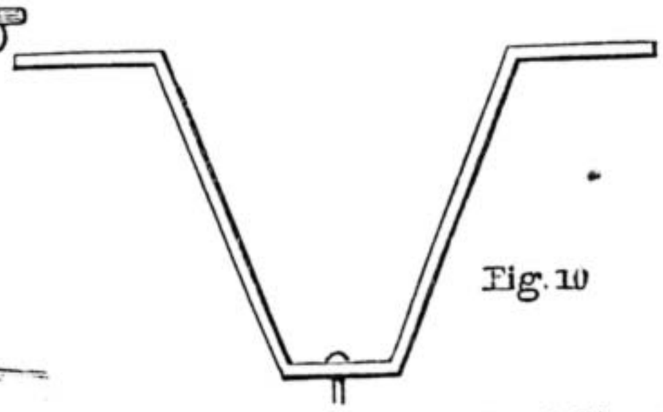

Fig. 10

THE MAIL CART: HOW TO MAKE IT. (*For Description, see next page.*) **Fig. 1.—Diagram showing Step. Fig. 2.—Diagram showing Front Stay and Leg. Fig. 3.—Side Elevation of Mail Cart. Fig. 4.—Back Elevation of Mail Cart. Fig. 5.—Method of shaping Handle. Fig. 6.—Alternative Form, in which Standards and Legs are Combined; Footboard to stand upon, the Seats lifting up; Standards tenoned on Top, and Top Rail mortised on; Piece of Oak 1 inch square fits upon Axle, Footboards and Springs being bolted to it. Fig. 7.—Diagram showing Plan of Seats in Fig. 3. Fig. 8.—Royal Mail with Box: Seat to act as Lid, Side all in one Piece, 12 inches high. Fig. 9.—Oval Spring for Fig. 3. Fig. 10.—Alternative Form of Spring.**

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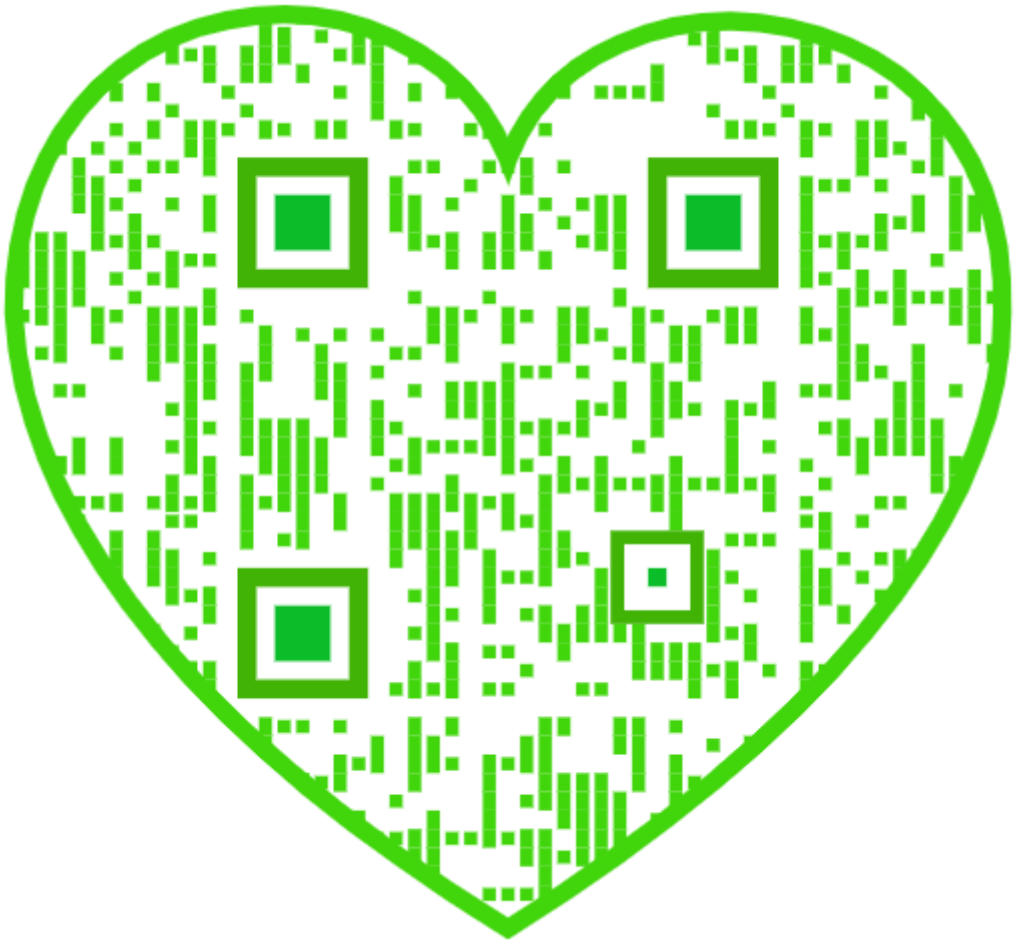

THE MAIL CART.

HOW TO BUILD IT AND FINISH IT.

BY W. P.

THE mail cart (Figs. 3 and 4) which I am about to describe is so simple of construction that any of my readers could make and put one together in an incredible short time. I have been asked which is the better for wear, wood or the rubber tyre wheels? Well, my experience of wheels is that a wood wheel will last fully three times as long as a rubber tyre wheel will. A wooden wheel after it has been in use a couple of years the hoop will become slack, so that the hoop will have to be made smaller by shrinking it up and rehooping the wheel with it again, the wheels afterwards lasting for a dozen years or more. The spider wheels last a long time, and wear very well if used carefully. The rims of these wheels are without the rubber, and are made stronger than the ordinary rubber tyre wheel. The rims are of two different shapes; one is quite round, whilst the other is flat at the outside, or nearly so. The rubber tyre wheel is at present a general favourite, and has superseded all other wheels, both for bassinettes, mail carts, etc. On account of the rubber it runs along easy and noiselessly, and looks light and elegant in appearance. With a continuous pressure upon the rubber it causes it to flatten out, gets cut up with sharp stones, etc., and is a continuous source of trouble after it has once been "started." Some object to wooden wheels because they look heavy and make a grating noise when wheeled on the flags. A list of the wheels and the prices will be found below.

Wood wheels, a pair 22 or 24 inches high, from 4s. to 4s. 6d.
Spider wheels without rubber, springs, and axle, from 7s. to 7s. 6d.
Rubber tyre wheels a pair, with axle only, from 5s. 6d. to 6s. 6d.

In almost every town will be found tradesmen from whom the reader can buy his requirements, but the above-named articles he may purchase at any cyclist's shop, or any place where bassinettes are made or sold, or at any large toy dealer's. The size of the wheel which I am describing is 24 in. high, or the largest size they make for mail carts. The axle is $\frac{1}{2}$ in. square, and measuring across from cap to cap of the wheels will be $22\frac{1}{2}$ in.

We will now consider the kind of wood we are to make our cart of. In the ordinary cheap mail cart it is of stained deal, whilst the better sort are of pitch pine or ash; either of these two will do, but I prefer ash. We can either buy the wood in a piece and saw it into required lengths, or buy it ready for working. Ash is sold at threepence per foot of 1 in. thick, 2 in. thick sixpence, 3 in. thick ninepence per foot, etc., or threepence for every additional inch per foot. Ash can be bought off any English timber dealer, coach builder, or wheelwright. The measurements enumerated below are as they will be when sawn, planed, and finished off, so therefore allow for sawing and planing.

1 Pair of Shafts	52½	in. long,	2	in. wide	1¼	in. thick.
4 Standards	18	,,	1¾	,,	¾	,,
2 Bottom Side Rails	24	,,	1½	,,	¾	,,
2 Top Side Rails	22½	,,	1½	,,	¾	,,
Board for the Seat	13	,,	14¾	,,	½	,,
2 Steps or Footboards	12	,,	3½	,,	¾	,,
Back Rest	16¾	,,	3½	,,	½	,,

In planing the pieces always get two sides of the piece true to work from. Mark with pencil to show which is the true side, as one must be at the top and the other at the outside. When finished planing, we round the ends of the shafts. a little, also the ends of the rails, and at one end of the standards only, which is to be at the top. We now dress the handles off on the shafts, measure 6 in. from the end of the shaft, draw with the pencil, and dress the handle off same as Fig. 5. Do not dress too much out with your spokeshave, but file it a little. The sides of the handles are left square, the average only taken off and slightly rounded.

If possible a large drawing, full size, should be made upon a blackboard, wall, or floor in chalk, or with a crayon if on a white wall; by placing our work upon the drawing it would enable us to work quicker. We lay the shaft upon the bench or floor with the true side towards us. Place the standards in their right position slanting towards each other at the top. The measurement from the top of the shaft to the top of the standard is 10 in.; measuring from across the top of the standards from the ends it will be 21 in., and at the bottom $28\frac{1}{2}$ in.; measuring from underneath the shaft to the end of the standard it will be $8\frac{1}{2}$ in. Get your pencil or steel scriber and mark each side of the standards on the shaft, press the standard down to keep it from shifting, and mark the standards from the sides of the shaft; when marked, number the standards, and the places marked on the shafts to correspond.

Get your shaft and square across the underneath side from the lines we marked where the standard was. Next set your gauge $\frac{1}{4}$ of an inch, and mark from the true side just across where we have squared it; this marking is only done at the bottom side of the shaft, recollect, as the top end is not touched at all. When all four have been marked we get our tenon saw, and saw within the lines, and down to the gauge mark; pare this out with your paring chisel, beginning at the gauge line, and slanting up to a feather edge at the top.

We now fix a standard into this rebate. Fix all the standards on the shafts; measure from the top of the standard to the top of the shafts to be certain that it is 10 in. before boring a $\frac{1}{4}$ in. hole through the centre of the standard and shaft. Fasten together with a cup-head bolt $2\frac{1}{2}$ in. by $\frac{1}{4}$ in. thick, let the bolt head be at the outside of the standard, and be sure to put an iron washer under the nut when screwing up.

When all the standards are fixed, we next fasten our side rails upon the outside of the standards. Get your short rail and place it an inch from the top; let the ends of the rails stand over the end of the standards. Screw this rail to the standards with a couple of stout screws $1\frac{1}{4}$ in. long, the head countersunk level with the rail; the screws can be either brass or the common sort, the points being dipped in oil before screwing up.

Next get the other rail and place it under the other, leaving a space between of $2\frac{3}{4}$ in.; screw this rail upon the standards, and when both the sides are finished like this we commence to fix our springs under the shafts. As there is such a variety of springs, I think it best to keep to the simplest in design and make. The oval-shaped one (Fig. 9) as seen on the cart is made of 1 in. spring steel, $\frac{1}{4}$ in. thick, and measures across the inside 12 in.; from the axle to the shaft $6\frac{1}{2}$ in.; the other spring (Fig. 10), though a different pattern, will be the same in length and height as the above mentioned.

If we are to have our mail cart to run true we must be particular in fixing our axle on right. If you notice on the spring which fits the axle you will see a bolt hole. Now this hole must be in the centre between the standards. When we have got it so, get your lead pencil and mark the holes which are in the springs on to the shaft, bore through the shaft with $\frac{1}{4}$ in. bit, and put 4 bolts $2\frac{1}{2}$ in. by $\frac{1}{4}$ in. thick, screwing the nuts up underneath the top of the springs. Now measure from the bolt hole to the end of the shaft to enable you to set the other spring right. When the other spring is fixed, we fix the axle upon the springs, place a leather washer between the spring and axle, and put a cheese-head bolt through $1\frac{1}{4}$ in. by $\frac{1}{4}$ in. thick, and rivet the bolt end, holding a heavy hammer on the bolt head whilst you rivet the end to keep the nut tight.

We are now ready for fixing our seat. We saw this piece 13 in. by $14\frac{3}{4}$ in. into five pieces, two 5 in. wide, and three $1\frac{1}{2}$ in. wide; when planed and finished off get one of the small pieces and screw it down in the centre of the cart just over the axle; put the other two pieces, each to be near the standard, then screw the two larger pieces between the smaller pieces, as in Fig. 7.

In sawing, countersink the heads level with the seat. The seat can be fitted up if desired with one board instead of the pieces.

We now get our steps or footboards (Fig. 1). Measure from across the bottom of the standards; this we suppose to be 12 in. Get a piece this length by $3\frac{1}{2}$ in. wide, hold the piece, letting the sides come flush with the sides of the standards, and mark with the pencil; get your saw and saw this piece out where marked $1\frac{3}{4}$ of an inch. At the outer ends near the standards we round the step; serve both steps exactly alike, and put a screw through the standards into the footboard.

We are now ready for our back rest (this with the seat can be made of deal). Measure across the inside of the top rail, which we will suppose is $16\frac{3}{4}$ in. Get a piece this length and $3\frac{1}{2}$ in. wide by $\frac{1}{2}$ in. thick; fit this within the rails; then mark each side of the rail on the edge of the back rest; take out and round the end to the pencil mark; fix this back rest right in the centre and over the axle, and screw from the outside of the top rail. We now get four small blocks $1\frac{1}{2}$ in. long and 1 in. square; the average is planed off one edge and the top; these are glued in the angle of the back rest and the rail; also put a screw in the block from the outside of the rail.

We next procure our ironwork for the feet. These are of the same width and thickness as the springs; these cranked stays and feet are in two parts (Fig. 2). The part which fits under the seat and running in the direction of the shafts is 7 in. long; from the end of the seat down to the step it is $8\frac{1}{2}$ in.; from this underneath the step $3\frac{1}{2}$ in. We now have a leg to fasten on this plate or stay; for the front it will be $9\frac{1}{2}$ in. with the end twisted up, measuring from the footboard altogether $13\frac{1}{2}$ in. long, as 4 in. of the leg are bolted on the other ironwork; the legs at the back are 6 in. from the footboard, also 4 in. bolted to the other ironwork. These plates should be fixed under the seat $1\frac{1}{2}$ in. from the side of the shafts.

We have now finished making our mail cart as shown in Figs. 3 and 4; when we have bolted the ironwork together, the woodwork can be stained and varnished over with oak varnish. To make the ash a pretty colour, get some old dark gold size;

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give it a coat when dry; wash it well and give another coat, stopping the screw holes up with putty, and finish off with some old oak varnish.

The mail cart which I have described is the easiest to make, and all the others of whatever shape or design are made upon this principle. The iron legs can be dispensed with by letting the standards be longer, according to the height of the wheel—9 in. longer—and below the footboard, and 6 in. for the back standard, if the wheels are 24 in. high. Fig. 6 has a footboard 8 or 9 in. long at the back and front to allow the riders to stand up when desired, the seats lifting, or as a sort of lid resting upon the shafts, and screwed with brass hinges to a piece fastened under the back rest. Fig. 8 has a box under the seat; the lid of this can be in the centre of the seat, and should have a few holes bored in the side of the box to allow air to enter. Observe the springs; these are half a circle, 1 in. by ¼ in. thick, and 5 in. high, fastened under the shaft and on to a cross-bar of ash or oak 1 in. square, and upon which the axle and footboards are fixed.

SIGN WRITING AND LETTERING.

BY HENRY L. BENWELL.

THE MANUFACTURE AND PREPARATION OF SIGNBOARDS.

THE manufacture of signboards is, of course, the work of the carpenter, but as the sign writer has often to give orders for their construction, it is just as well to give the proper and necessary instructions to the carpenter at the outset, in order to ensure a good article being made. A few remarks on this subject can therefore be hardly out of place in these articles, so it is my intention to give some simple directions as to making a signboard, and painting and preparing the surface ready for receiving the sign writer's inscription thereon.

Before I proceed further, however, I may perhaps be allowed to explain that the one object these articles have in view is in lending a helping hand to the novice and apprentice who is taking up this particular branch of decorative art. To all those, therefore, who have already a full knowledge of the art, and are past teaching and even learning, my advice—as far as these articles are concerned—is to pass them over.

These words from me have been called forth by the remarks of correspondents who have complained about the elementary character of these articles. Therefore, I repeat they are meant to be elementary, and that I do not profess to write for the skilled workman. For my own part, I cannot understand a man who knows every trick and wrinkle in his trade wasting his time in reading these pages; but in my past experience I have always found this to be the case, that those people who are so learned, so well up in their work, and, in fact, boast so much about their knowledge, and consider themselves above any further instruction, are generally those very workmen who know next to nothing of their particular trade, especially in its best departments. No sensible person, however clever and skilled a workman he may be, need consider it derogatory on his part to peruse an elementary treatise on the handicraft at which he gets his living; in fact, the oftener he recommences at the beginning, the more proficient he is likely to be, as a workman, in his adopted calling.

The wood used in the manufacture of signboards must be well seasoned and perfectly dry when being worked, and as far as possible free from knots. The wood mostly used is the best pitch pine, free from knots. Oak is sometimes used, but it is harder to work, and more expensive.

A signboard should contain as few joints as possible, so it is advisable to have the boards used in its construction as wide as possible. Neither must they be too thin—at least, 1½ or 2 in. thick—or a very flimsy article will be the result. The boards must first of all be planed up smooth and perfectly true, and tongued and grooved, which, the better to prevent them opening, should be done in dovetail manner. The boards are now laid face to face dowwards, and close together upon some level surface, and are secured at the back with ledges or cross pieces firmly attached with plenty of strong screws. These cross pieces should not be more than two feet six inches apart. Now a good many people will at once say that the boards should be "clamped up" before having the cross pieces affixed, but to do this would be a great mistake, for signboards are exposed to all weathers, hot and cold, wet and dry, consequently they undergo a large amount of expansion and contraction. Consequently, if the boards were "clamped up," which they frequently are, no allowance is made for this expansion, and therefore, on the first appearance of wet or damp weather, the boards, naturally expanding, exert a tremendous force against each other, which causes the whole signboard to warp and. twist in all directions; nor is this the worst, for the whole structure having been now pushed apart in this way, the boards, contracting with the first dry weather, will have glaring cracks in place of the previous almost invisible joints. It therefore devolves on the carpenter to use his utmost skill and knowledge to obviate and allow for this swelling and shrinking when making a signboard. There is a much more scientific way of making signboards than the one described herewith, with the special view of doing away with all these defects, but the writer is not sufficiently acquainted with the method to describe it in this place.

A signboard is "finished off" by having an ornamental moulding placed around it. This moulding should be rebated, mitred at the corners, and placed around the signboard, exactly as a picture is framed, and screwed thereto at the edges, and not from the front.

These few remarks may assist the young sign writer in giving his orders to the carpenter; in fact, he should write out a short specification in order to avoid disputes. A carpenter who is in the habit of making signboards a speciality can generally be relied upon to turn out a good article without receiving special instructions; but that there is a lot of bad and scamped work turned out in this direction can easily be seen on noticing the cracked, warped, and twisted signboards which one discovers on all hands, totally destroying all the labour and art which has been bestowed upon them by the aspiring and painstaking sign writer.

The carpenter having delivered the board properly glass-papered and perfectly smooth, we now proceed to prepare the surface ready for lettering. This job is generally handed over to the ordinary house painter, or an apprentice, and they are allowed to do the work in their own way, with the very natural consequence that the sign soon after completion is one mass of blisters, or the colour fades or cracks all over. It may not pay the sign writer—especially if he be a clever man and fully employed—to do this work himself, but whenever and wherever possible, he should always have it done under his immediate supervision, for on the lasting result of the signs he paints rests his reputation; and if at any time a sign does go wrong, he will not only get the whole of the blame, but in nine cases out of ten will lose any future work from the same customer. It behoves him therefore to see that great care is taken in preparing the groundwork of his signboards.

In good firms men are kept who understand the whole process thoroughly, and in such cases I need hardly say the "writer" need give himself no trouble; but when one works for the trade generally, and especially for men in a small way of business, he must see to these things if he wishes to keep up his connection.

There are, again, a good many ways of preparing signboards, all of which have their advocates and detractors alike, so it will perhaps be best to describe more than one process.

But it is no matter what method the workman may adopt, he must, *if there are any*, effectually destroy the damaging power of any knots. These must therefore be carefully coated with patent knotting, glass-papered, and again carefully coated. The panel is now primed with red and white lead, half and half, raw linseed oil, and a little dryers (not liquid dryers); a little turpentine may be added, and the priming should be thoroughly strained. When the first coat is perfectly dry, it may again receive a second coat of the same composition, but both must be laid on very thin and sparingly, especially if the panel is made of oak or mahogany. This priming must be allowed to get quite dry and hard, and then it may be well rubbed down with glass-paper.

The sign now receives a sparing coat of the ground colour mixed in the ordinary way, allowed to get dry and hard and glass-papered. This process is repeated, but this time it is glass-papered with extra care. It next receives a good round coat of "flatting" of the same colour, and if this does not sufficiently cover, it must be lightly rubbed down with some fine glass-paper and again "flatted." It must now be decided whether the panel is to be varnished before or after lettering; if the former, it now receives two good coats of copal or amber varnish; if the latter, it is ready for the writer without any further work.

In Spon's "Workshop Receipts," the following method is described:—

"Brush the board over back and front with equal quantities of linseed oil, japanner's gold size, and turpentine, to which add a little ground white lead, driving or rubbing out the colour well. For the second coat take equal quantities of white lead, common spruce ochre, and whiting, all well dried and ground fine and stiff separately with raw oil; mix the whole together; add sufficient gold size to cause it to dry quickly, firm, and hard; dilute with turpentine to a proper consistency, and apply two or three coats of the above colour.

"When dry and hard rub the surface smooth with either sand-paper or pumice stone and water, then grind equal portions of spruce ochre, whiting, bath brick, and white lead with two parts oil and one part turpentine, adding a little gold size diluted with turpentine, and apply one, two, or

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three coats if necessary, taking care to rub down and wash off the panel between each coat, repeating rubbing and colouring until the surface is as smooth and level as plate glass. It is then fit to receive the last coat to write, marble, or grain upon."

The finishing application, whether it be a plain ground, landscape, figures, or letters, ought to stand until thoroughly dry and hard; it should be finally varnished twice over with the best body copal or amber varnish, as the delicacy of the painting will admit.

HOME-MADE TOOLS.

BY J. H.

Miscellaneous Planes.

Fig. 19 shows a section through a bull-nose rebate plane. The use of such a plane is similar to that of a bull-nose smoothing plane, only that the one is used for working rebates close up to a shoulder, while the other is for plain surfaces simply. Such planes cannot well be made in wood because of the weakness of the nose in that material, but in iron they are strong as well as serviceable. Fig. 20 shows a plan view of the iron. It is shouldered and extended to the full width of the outside faces of the plane, and the flat face is downwards and the bevelled facet upwards, as in all planes whose irons are set at a low angle.

Figs. 21 and 21A show the patterns of the plane in elevation and plan, Figs. 22 and 22A the core box, also in elevation and plan. The mutual correspondence of these will be evident on comparison. The core outline is dotted in Figs. 21 and 22, and the print, A, is seen to correspond with the width, B, in Fig. 22A. In this example the sides, C, of the plane (Fig. 22) are put in the core box, and the hole, D, for the escape of the shavings is also made in the box, so that nearly the whole of the plane is formed in the core. This is an alternative of the method described in the previous article.

This may be cast either in iron or in gunmetal, it matters not which, and sizes may vary. The bedding of the iron on its face, and the good fitting of the wedge against the under face of the bridge piece, are to be particularly attended to. In this, as in other matters, the instructions already given in reference to previous examples will hold good, and need not, of course, be repeated.

A screw may be tapped into the hinder end of the plane to receive the hammer blows for the loosening of the iron, as noted in a previous example.

Round and hollow planes cost about 2s. 3d. each, and a workman wants a large number. I have seen very many planes made by workmen to supplant the shop-purchased ones, and they answer every whit as well. Figs. 23 and 23A show one of these wooden "rounds" in section and plan.

In making wooden planes there is not much difficulty, but a little care is necessary. In the first place, the stuff for the plane body is squared to width, depth, and length, the silver grain running vertically, or at right angles with the face; and the opening for the escape of the shavings, the seat for the iron, and for the wedge, are carefully marked with a scriber. Then bore holes with a small bit into the mouth. Bore other holes into the opening above, not too deep, but only sufficient to ease the work of the chisel and mallet in cutting out. Do not cut too much out of the mouth at the commencement. This is where a beginner is apt to err and to spoil his work. If the full width of mouth is cut away at once, then when the bedding of the iron, and easing off, and finishing comes to be done, the chances are that the mouth is at once widened as much as it would be if the plane had been in use for a long period.

In cutting out the opening, the chisels used must be as sharp as possible, and, with a flat piece of wood whitened with chalk, check from time to time the truth of the faces which are being cut. A new and coarse flat cut file may be used at the finish to remove the chisel marks and impart a smooth surface.

There is a risk of starting a shake in the angle where the front edges of the wedge fit. Hard driving of the wedge will do this, even if the wood of the plane is perfectly sound at the commencement. For this reason the front edge of the wedge should make perfect contact with its groove, and not be touching on one corner or opposite corners only. Also the chamfer should not start off at too sharp an angle, because that will weaken the wood just where the greatest driving stress occurs.

The surface of the plane should be saturated with boiled oil, which will afford a hard protective coating and gloss to the wood. Over this, when dry, a coat of varnish may be employed with advantage, protecting the wood from the weather and improving its appearance.

Every workman can make for himself small thumb planes — that is, miniature smoothing planes. They are very useful tools. They may range in length from four to seven inches. Single irons for these, from about ¾ in. in width, are obtainable in the shops.

It is often the case that pattern makers, carpenters, and joiners, want to work out mouldings, plain, hollow, or ogee around curves. Of course, much of this work can be, and is, done by machine, but not in all shops. In such cases I have seen planes something like that shown in elevation, plan, and section, in Figs. 24, 24A, and 24B, improvised in the space of a few minutes out of a bit of deal worked to the radius of the moulding transversely, and to its curve longitudinally.

They may, for a temporary purpose, be cut from a bit of deal, and they will, for temporary service, answer every whit as well as planes made of hard wood. To lessen the labour still more, I have seen the place for the iron and wedge cut clean out through one of the sides, as in Fig. 24, with a tenon saw. A rough plane like this, cut out for its iron and wedges, and sweeped in two directions, can easily be improvised in half an hour, and will save that small amount of time over and over again, by comparison with the time occupied in working a circular moulding laboriously with an outside gouge.

When its purpose is fulfilled, the plane may be thrown away if its rough appearance is an eyesore, or put away on a top shelf for possible future service.

It is impossible to work long flat sweeps true with a spokeshave, because the base or sole of this tool being so short permits it to rock and roll about, and so to follow, to some extent, the rough contour of the stuff as originally prepared with saw or gouge. To prevent this waviness, and to properly obliterate all lumps, a plane having a sole of considerable length is required. This then rides over the minor projections, and adapts itself to the general or average curvature of the sweep, and so produces true work.

Sometimes workmen make a tool somewhat resembling a spokeshave, but having an iron like a plane iron, and a sole about twice or three times as long as that of the spokeshave. In this way fairly good sweeps can be worked. But still the plane is the best tool for the purpose, and to one of this type the term "compass plane" is applied.

Compass planes, Figs. 25 and 25A, are, therefore, those whose curvature is in the transverse direction to that in Fig. 23, that is in the longitudinal direction of the work. A common smoothing plane is often utilised thus as a compass plane by having a suitable amount of curvature imparted to its sole. But obviously it is not possible to work sweeps accurately with a plane whose

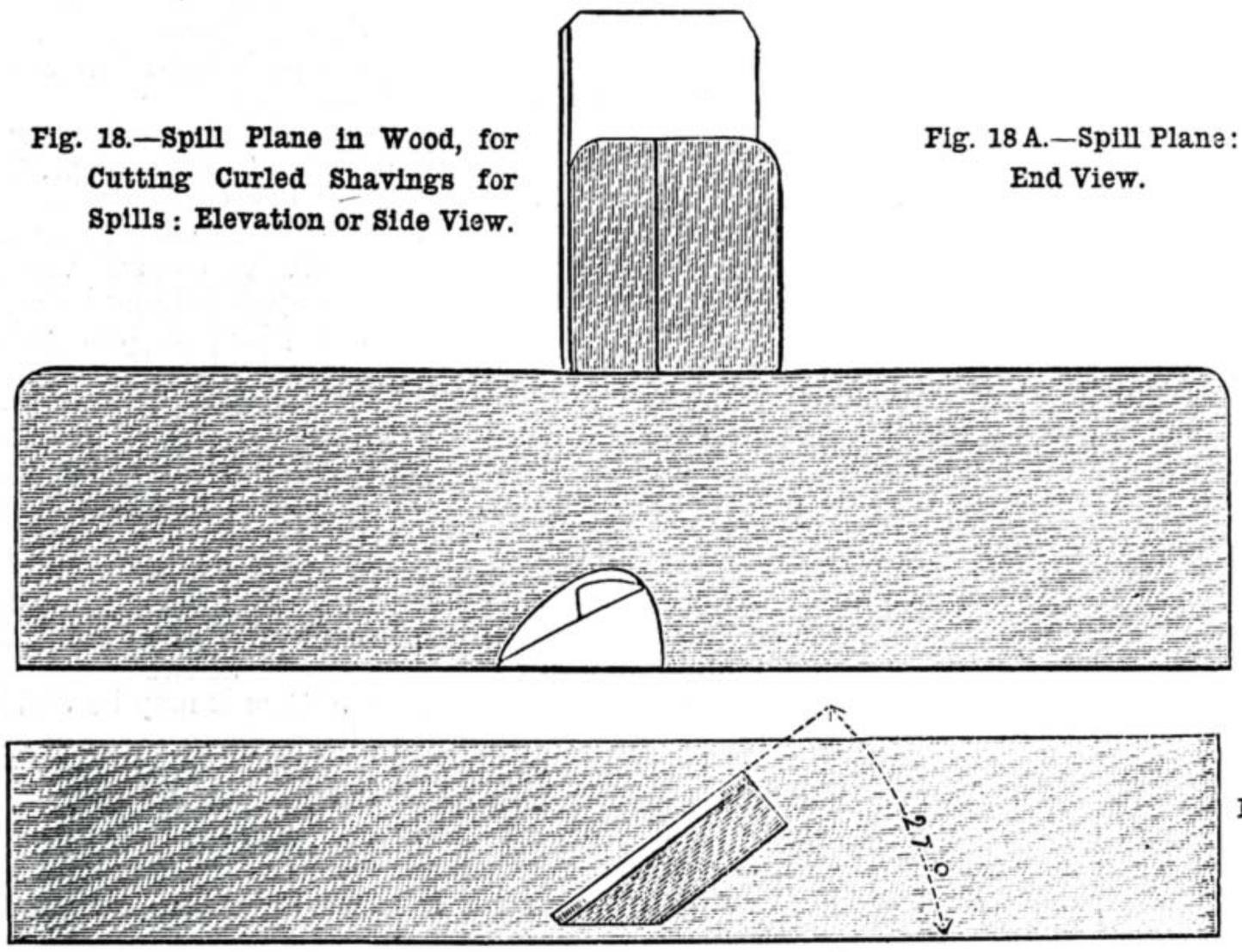

Fig. 18.—Spill Plane in Wood, for Cutting Curled Shavings for Spills: Elevation or Side View.

Fig. 18 A.—Spill Plane: End View.

Fig. 18 B.—Spill Plane: Plan.

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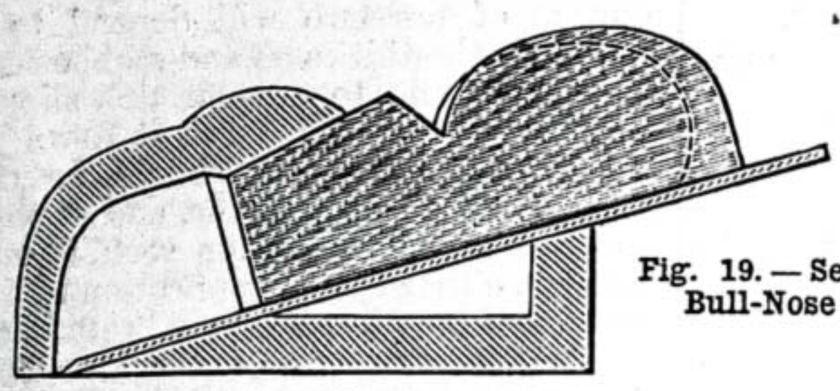

Fig. 19.—Section of Bull-Nose Plane.

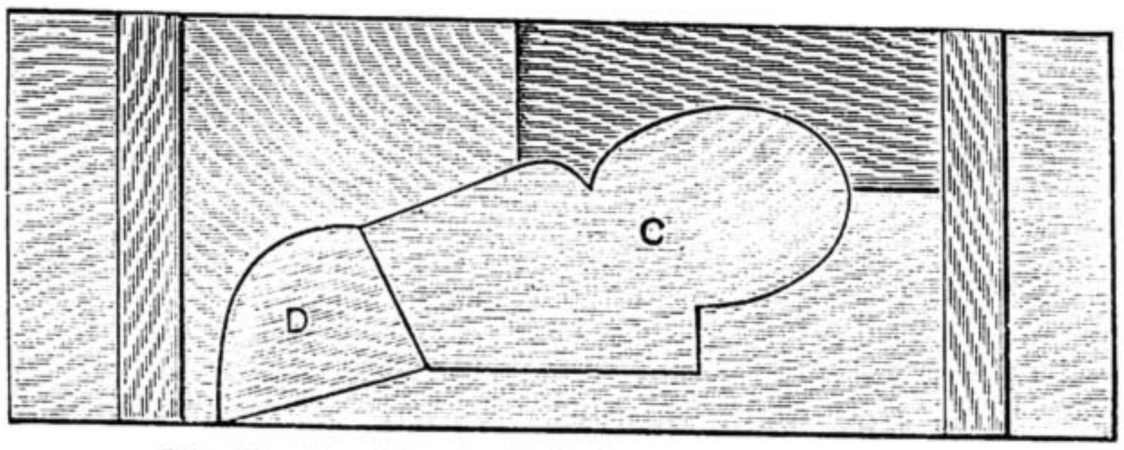

Fig. 22.—Core Box for Bull-Nose Plane: Elevation.

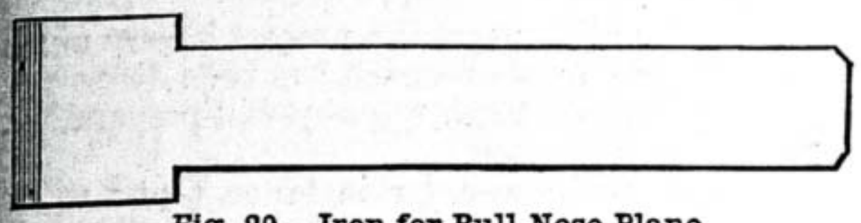

Fig. 20.—Iron for Bull-Nose Plane.

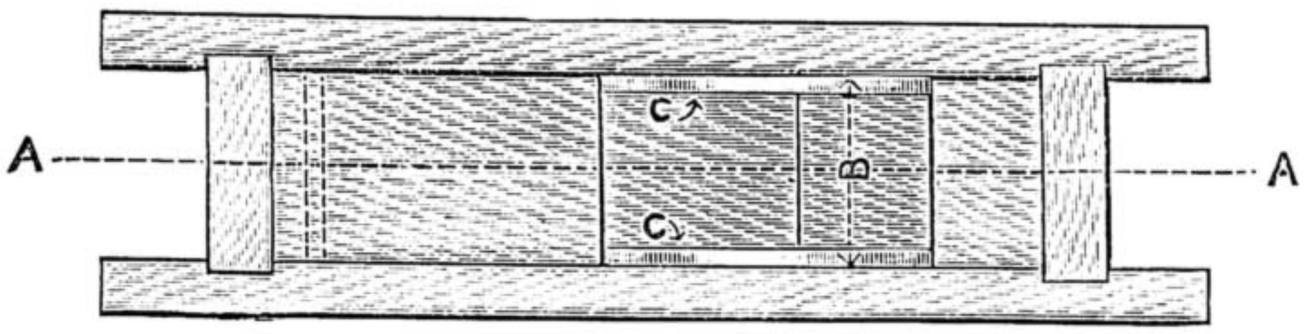

Fig. 22 A.—Core Box for Bull-Nose Plane: Plan.

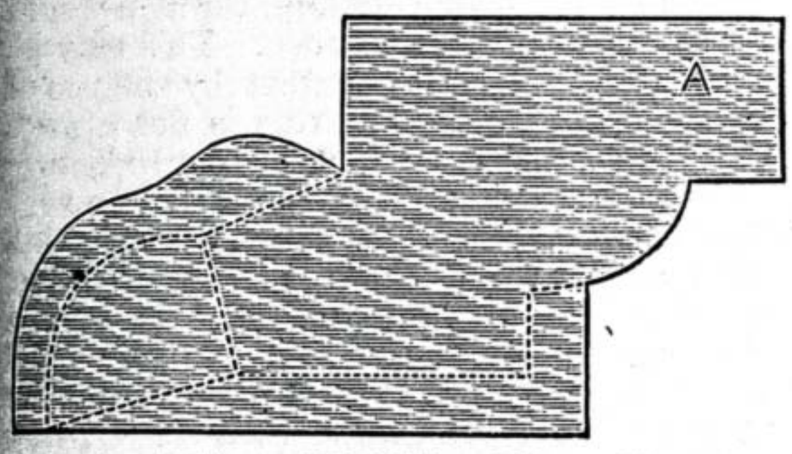

Fig. 21.—Pattern of Bull-Nose Plane: Elevation.

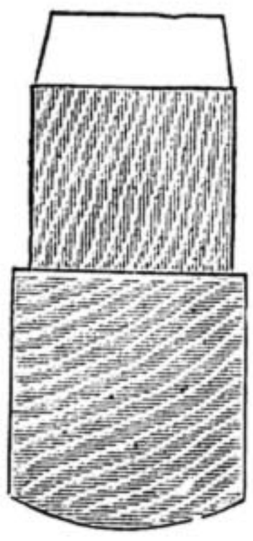

Fig. 23 B.—End View of Round-Soled Plane.

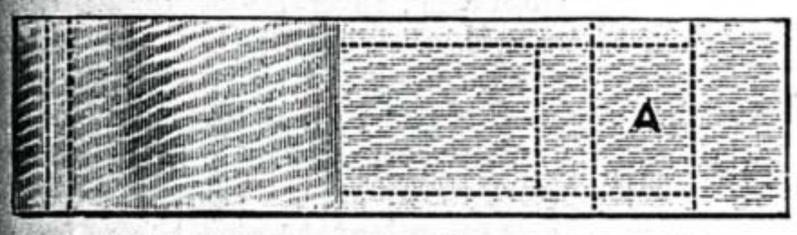

Fig. 21 A.—Pattern of Bull-Nose Plane: Plan.

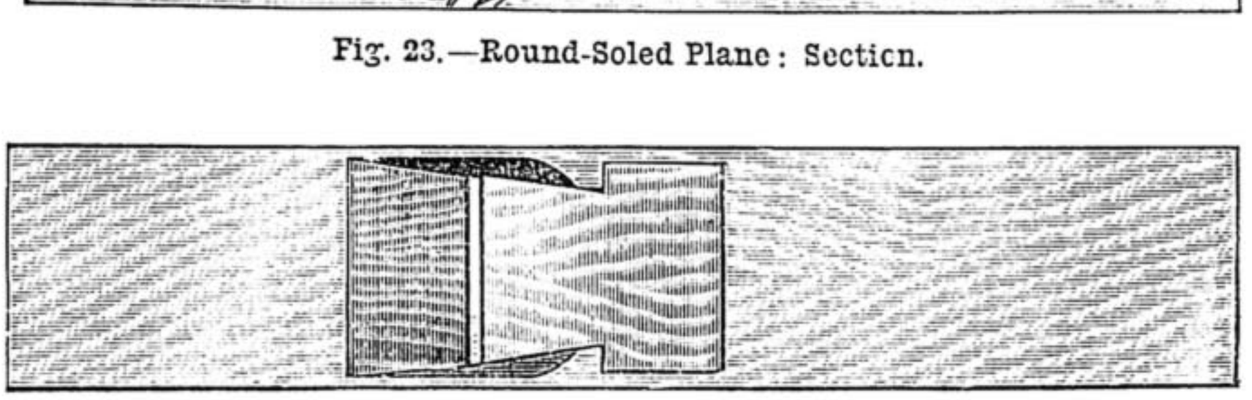

Fig. 23.—Round-Soled Plane: Section.

Fig. 24 B.—Section of Rough Plane.

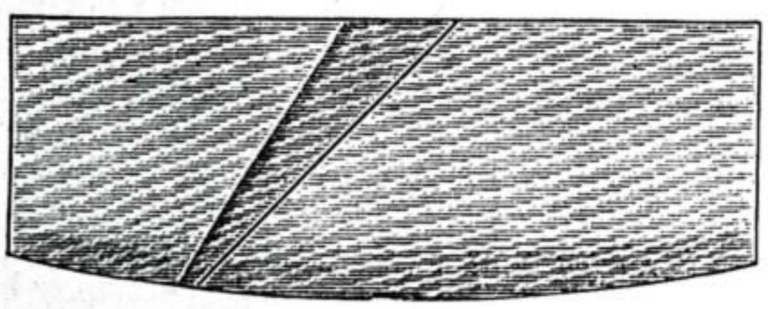

Fig. 24.—Rough Plane for Temporary Use.

Fig. 23 A.—Round-Soled Plane: Plan.

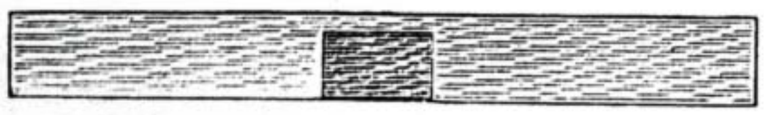

Fig. 24 A.—Plan of Rough Plane for Temporary Use.

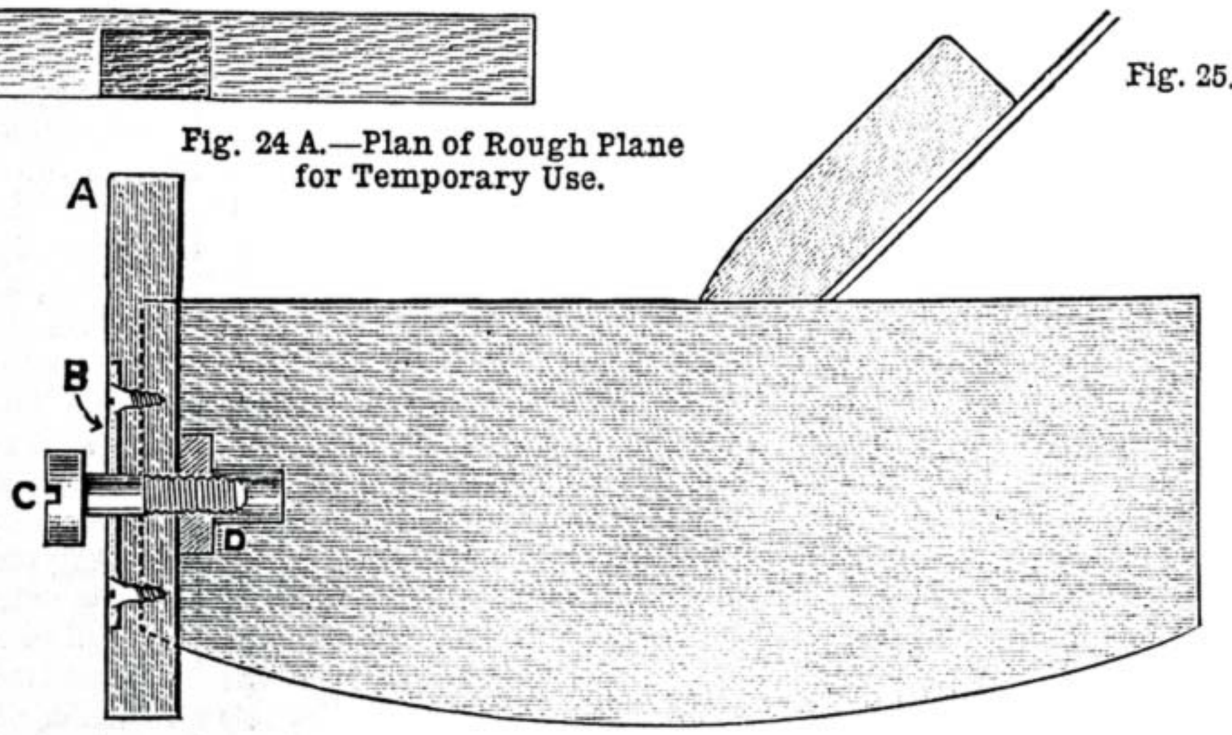

Fig. 25.—Compass Plane: Elevation.

curvature is very much quicker than that of the sweep which is being worked, while, further, it is impossible to cut a sweep that is at all quicker than the curvature of the plane itself. Hence we want properly a separate plane for nearly every separate sweep, manifestly inconvenient on the score of expense. Hence the great utility of those American sweeped or circular planes having an elastic sole of steel, and a screw, and double lever arrangement with interlocking teeth by which any curvature, either convex or concave, can be imparted to the sole. But these are costly, hardly within the range of amateur work, and are not so well adapted to the rougher kinds of work as a plane of wood. Fig. 25, therefore, shows a device for making a compass plane adaptable to any reasonable range of curvature.

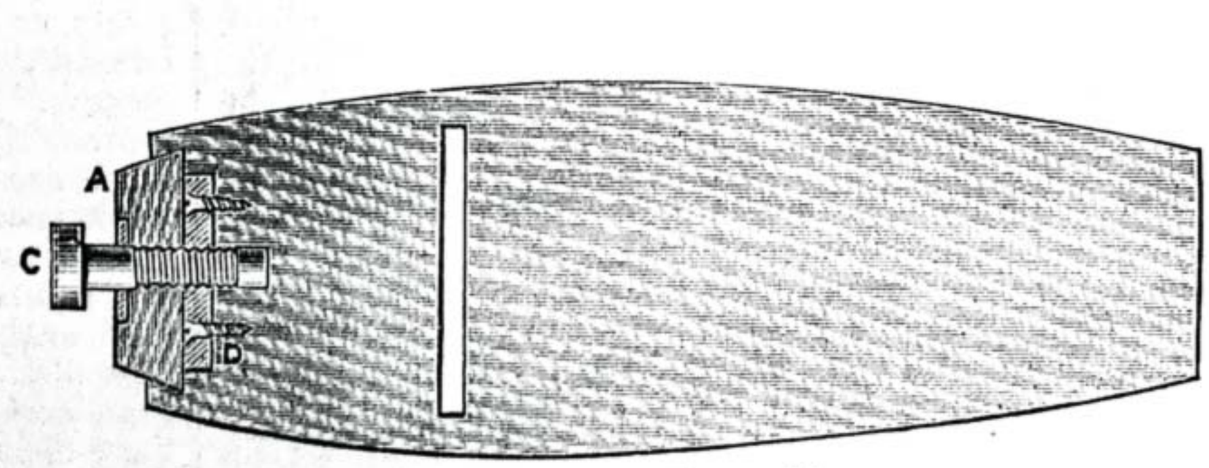

Fig. 25 A.—Compass Plane: Plan.

In this a dovetailed adjustable slip, A, is fitted into the front end of the plane with a vertical range of about $\frac{3}{4}$ in. A brass slotted plate, B, is let into and fastened with a couple of screws into the outer face of the slip to take the pressure of the set screw, C. A bit of brass or iron plate, D, tapped to take the set screw, is let into and screwed to the end of the plane, as shown, the set screw being tapped into this, and the loosely dovetailed and slotted piece sliding over the screw body, therefore the turning of the latter with a screwdriver pinches the adjustable slip, A, in any required position, rendering it suitable to a flatter or quicker sweep, according as it is set more or less away from the sole of the plane.

Fig. 18 shows a spill plane made in wood, one of those little articles by which the

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curling of the shavings used for pipe and cigar lights is effected. These spills look rather pretty on the mantelpiece; the worst of it is that the ashes drop off them as they burn. Gluing thin pine and mahogany together before planing off the spills gives them a pretty variegated appearance.

The important point in these planes is to get the precise angles required; a very slight departure therefrom will prevent that close curling together of the shavings which is essential to good appearance. Both the angle of the iron and of the sole of the plane are of equal importance.

Figs. 18, 18A, and 18B show the plane in side, end, and plan views. A block of wood is planed rectangular to the dimensions shown, and then the hole marked and cut for the wedge and iron, the iron standing vertically. Afterwards the bottom of the plane is rebated through to coincide with the transverse angle to which the iron is ground; the angle of the iron in plan is 65°.

I scarcely think it worth while to occupy valuable space with any detailed description of the mode of construction of the ploughs, filisters, routers, and various bead and moulding and sash planes used by carpenters and joiners. They are very common, and many are made by workmen themselves, many are bought second-hand. In any case, there is no difficulty in their mode of construction. Perhaps the most difficult to many would be the plough, because of the bit of metal work involved. But if the body were described and made, a set of irons would have to be bought, and then it would be cheaper to buy a second-hand plough and irons in good condition. The same remarks apply in the main to the other planes mentioned. The examples which I have selected have been mostly those of planes involving the employment of cast-iron bodies, in whose construction I think most of my readers might be expected to have less acquaintance than with the working of wood. Hence, although I have not by any means exhausted the stock of useful planes, my instructions have embraced all, except some of the most elaborate types which few could undertake with hope of success, and those common planes in wood which are better bought than made. I shall pass on in future papers to the description of some other classes of tools, of which there are many kinds awaiting notice.

The value of these and other home-made tools does not consist altogether in the saving in cost effected over those which are purchased ready made, although that is in some cases very considerable. But they have a much wider value, common to all work undertaken in leisure hours by amateur and professional mechanicians. These are the acquisition of that practical skill which can come only of experiences of failure and success, the intimate knowledge gained thereby of processes and operations, the pride begotten of the successful accomplishment of tasks more or less difficult, the useful and happy employment of hours which might otherwise be given to idleness or to positive vice, the keen interest which grows with devotion to pet hobbies, and the satisfaction of contemplating time past well spent and tasks well done. The stress of life would overwhelm many a man but for his pet hobbies, and it matters little what those hobbies are so that they are innocent. They ever serve the happy purpose of keeping us from brooding over life's worries, and breaking down under its cares, an end which all must desire.

VENEERING PANELS, ETC.

WITH REMARKS ON THE TREATMENT OF LIGHT VENEERS AND BURRS.

BY DAVID ADAMSON.

LET us now suppose that two drawer fronts or panels of the same size have to be veneered. The general work will be exactly as before, but it will be more convenient to place them together with a couple of cauls, the backs of the panels being in contact. This is mentioned as I consider it a better plan than placing the veneered sides together, or, rather, with one caul (metal) between them, though this is done by such very good workers sometimes that I feel loth even to insinuate that it is not altogether desirable, and I certainly would not go the length of saying that it is wrong. If pairs of panels are done, on taking them out of the caul instead of placing them separately against a wall, put the veneered surfaces in contact, and leave the work undisturbed for a few hours in a warm place, when all that has been said applies equally to their after treatment. Perhaps before leaving this part of the subject it should be said that many people before gluing the ground wood size it over with weak glue, just to fill the grain. This may be advisable when the wood is soft, and can never do any harm even with hard woods. A good deal, however, depends on the consistency of the glue, so that whether sizing is necessary or not must to a great extent be left an open question.

It may sometimes happen that both sides of a board must be veneered, and from what has been said about heart side and damping the back the novice may possibly put a few questions to himself which he will find difficult to answer. To save him from any perplexity, he may be told that when both sides of a piece of wood are to be veneered the wood does not require swelling, and that the rest of the work is exactly the same as when only one side is to be veneered. The wood, when ready, is placed between two cauls.

Let us now suppose similar pieces of wood are to be hammer-laid, and the caul dispensed with. The veneer will still be laid on the heart side of the ground wood, which will be glued as before, but not swelled on the back. As the work must proceed without delay in order to prevent the glue setting, everything required should be ready to hand. If the surface is at all large, a warm iron or two should be regarded as among the indispensables. Some warm water, say that from the outer glue kettle—but it must be clean—and a rag or sponge will also be wanted. If necessary, the surface of the wood may be slightly warmed. When all is ready, brush the glue on as usual, and as quickly as possible lay the veneer in position, pressing it down with the hands. Then with the damped rag wet the face of the veneer and squeeze it down with the hammer. To use this with the utmost force which is sometimes required, take hold of the end of the handle with the right hand, pressing with the left on the top of the head, and work the iron edge all over the surface. The moisture on the surface of the veneer should not be excessive, though it must be sufficient to cause the hammer to slip freely over it. Where it can be done without injury to the veneer it is not a bad plan to have a small quantity of glue mixed up with the water to damp the rag. Sufficient will be got by wiping up that which exudes from the edges. The amount of pressure will depend to some extent on the thickness and stubbornness of the veneer, and to prevent this slipping it may be necessary to fasten it down with a pin or two. Blisters should be pressed down as much as possible, and if the glue seems inclined to set too soon, it must be softened either by the application of a warm iron, or, if only locally, by a heated hammer head. Sometimes the inner glue pot laid on any particular spot will do all that is required.

With all veneers the process is very much the same as that which has been described, but some of them want special preparation, and details vary.

Let us suppose, for instance, that a white or light-coloured veneer has to be laid. It would at once be apparent that if put down with a caul, the glue striking through would cause an irreparable blemish. This may be prevented to a certain extent by the use of light-coloured glue, but this is not always obtainable easily, so that it is satisfactory to know that the ordinary kind will do very well when mixed with some white material, such as powdered chalk, plaster of Paris, whiting, etc., any of which, it is almost needless to say, must be quite free from lumps or grittiness. One very good plan is to mix some of the white with size or very thin glue, and lightly smear the veneer with it on the side to be glued down. Put the veneer aside till dry, then lay as usual, the only difference, if any, being that the glue should be as thick as it can conveniently be. Another method is not to prepare the veneer by coating it with whitened size, but simply to mix the glue with white before laying. Sometimes it is sufficient to rub the veneer over with ordinary chalk dry; but so much depends on the colour of the veneer that it is almost impossible to lay down hard and fast rules. For example, though oak and satinwood are both light woods, it is evident that the latter is much the more delicately tinted of the two, and consequently more liable to injury. Among the lighter woods commonly met with in veneers requiring care in this respect may be mentioned the following:—Birch, bird's-eye maple, wainscot oak, satinwood, American ash, Hungarian ash.

In connection with these and similar veneers, attention may be called to the fact that the glue is not so apt to strike through when they are laid with the hammer as when the caul is used.

The advisability of thoroughly drying all veneers, and the absolute necessity of doing so with others, has already been alluded to; but, so far, it has inferentially been presumed that they are all of a flat, smooth kind. Burrs, however, are so much wrinkled and crumpled as to require special treatment before they can be successfully flattened out. Among these may be reckoned burr walnut, Amboyna, pollard oak, etc. If they lie flat, well and good; but if not, they must be damped slightly to render them limp and flexible. They should then be placed separately, or in a pile, between hot cauls, and left till they are dry, when they will be flat enough. Be careful, however, that they are thoroughly dry before laying them. All burrs are more or less faulty, and this remark specially applies to walnut, which is frequently full of great flaws and rents. These must be carefully pieced up, and on the way this is done a great deal of the effect depends. Of course, when skilfully patched, the pieces let in should hardly show, and on the finished surface they sometimes require a good deal of looking for before they can

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be discovered. As I have known amateurs, simply because they could not find any places which had been thus patched, fancy that they had got hold of a very superior piece of veneer, and cast a doubt on their informer's veracity, I may say to those who read this, and have similar notions, that it is almost an impossibility to get hold of a very fine piece of burr which has no holes in it. In fact, it may almost be said that the finer the markings the looser the veneer will be in this respect, so that in veneering with burr it is not only necessary to estimate the cost of the material, but of the time required to render it presentable. This is just one of those points in which the amateur valuer of furniture is apt to go altogether astray, and which lead him to fancy that he is being imposed on, while in reality he is trying, doubtless unwittingly, to drive a hard bargain. He argues much in this way. A walnut panel in the solid is worth so much. He is not to be had, and he knows the value of a burr veneer, large enough to cover it, to be, say, half-a-crown. Add this to the solid, and —well, yes, not to be unreasonable, a little more for sticking it to the wood, but that won't take long, as it's only a matter of a little glue and sticking the two pieces together—say 3s. for veneer and laying. The very important items of time and skill required to prepare the burr are altogether left out of consideration, though it is quite conceivable that they might be worth considerably more than the cost of the vencer. To show this in its unprepared condition to a person of such vast knowledge and experience would be useless, or worse than useless, for he would think it very poor, common stuff, and would much prefer to have a piece as smooth and perfect as a piece of cardboard.

And, without doubt, "so say all of us," only, unfortunately, it is not obtainable. Burrs won't grow according to pattern, and the wood from which they are cut is not machine-made. Uniformity in irregularity is all that can be expected from natural productions, and where they are not perfect for purposes of manufacture, skill and intelligence are required to make them so. We avail ourselves of the works of nature so far as they can go, and then by art we make them fit for the use we intend for them. This in the case of veneers is that they shall present a smooth, unbroken surface. Every piece of burr, therefore, must be carefully examined before laying, and the larger holes filled with bits cut to fit them. Small cracks and minute holes will be filled up by the glue when laying, so they need no special attention. To fill the others, it should not be deemed sufficient just to fill them up, though this, in any case, could hardly be done generally with pieces cut to fit. It is mostly necessary to trim away the rough edges, and in doing so the hole is enlarged. The aim should be to let in a piece so that it and the join harmonise with the rest of the marking.

In order that this may be achieved it will be seen that it would not do to cut the hole and piece fitted in to a regular outline, such as a square, circle, or oval. This would be too conspicuous, but with a small amount of discretion the joint should be almost imperceptible. The two pieces can easily be made to fit by cutting them both out at the same time. This may easily be managed either with an ordinary fret saw or with the point of a knife, as the veneer, especially if damp, is not difficult to cut. In using the fret saw for this species of inlay it is not necessary to cut on the bevel. The glue will fill up the saw kerf sufficiently. As the pieces are let in, a piece of paper should be glued over them and the surrounding veneer to keep them in place. Any odd scrap of paper will answer the purpose, and I suppose it is unnecessary to do more than state that it must be applied to the face side—*i.e.*, the one which is afterwards to be cleaned off.

In much the same manner burrs which are to be jointed to cover a larger surface must be treated, the edges being cut to fit each other in an irregular line, and then attached by glued strips of paper. As the thickness of different pieces of veneer may vary, they should be reduced as nearly as possible to an equality before laying by going over them with the toothing plane. This is necessary, as it stands to reason that otherwise the caul would not press them down all equally, and surplus glue or confined air would not be driven out to the same extent from under the thinner as from the thick portions. If an unusually large surface has to be veneered, it will be convenient to cut all the different pieces before joining any of them together. This is the general treatment to be adopted with burrs of all kinds, and they should, when at all practicable, be laid with a caul. The hammer does not do for them. Owing to the porosity of most burrs, the sheet of paper between the caul and the veneer must on no account be omitted, and be sure that the caul is either soaped or greased, otherwise the chances are that the glue will not only adhere to the base, but to the caul, and be injured. Nothing more need be said about burrs, of which the walnut variety is that most commonly met with. It must not be confused with plain walnut, though possibly this designation may be confusing to some, as implying that it is without figure. It frequently has plenty of this, but may be distinguished by its presenting much the same markings as a plank instead of a mass of involved figuring such as is seen in burrs.

Rosewood, from its resinous nature, requires somewhat different treatment from any of the veneers which have been considered. Instead of damping it like twisted burrs before pressing flat in the caul, it should be heated at the fire till the oil or gum exudes, and care must be taken that it is equally warmed all over. When the gum has apparently all come out, the veneer is then pressed till cold, after which it is ready for use. It should be said that some of the "bastard" rosewoods which are so often met with now, do not seem to require this special manipulation, but may be treated as if they were mahogany. As a rule they do not emit the peculiar fragrance of rosewood, but in case of doubt they may all be heated. If they contain no oil, of course heat won't bring it out, so that there need be no room for doubt. I believe it is not usual to heat knife-cut rosewood.

Many kinds of veneer have necessarily not been mentioned by name in these directions, but by noticing the leading features of any others which he may come across, the learner will have little difficulty in knowing how to treat them properly and lay them satisfactorily, and we may proceed to consider other matters connected with the art of veneering.

These, however, through want of space, I must defer for another paper, in which I shall consider for the benefit of all workmen, but more especially for the benefit of the improver, such things as blistering and other things connected with the art.

A MAURESQUE COFFEE TABLE.

BY E. BONNEY STEYNE.

How well-to-do folks pass the tempting windows of the warehouses of the Liberty type without buying half their contents is a wonder to poor amateurs. We (not you, my reader, of course) never have those pleasant spare guineas which are required to possess the delightful medley of china, brasses, hangings, and furniture, brought from the spicy East. The very scent of one of these shops is intoxicating, and almost sends prudence to the winds, and leaves one reckless to buy all that is so captivating, with no thought of payment. But although poverty has its pains, it has its pleasures, and the make-shift that does duty in home-made fashion for coveted but unobtainable reality, has a charm of its own in the eyes of its maker, who can trace it back to the first germ, if the idea of it be his own design, or can recall the pleasant sensation of being at last within reach of the long-admired original when some technical journal gives the recipe for cooking a substitute.

The pretty coffee tables sent over from Turkish possessions (it is kinder to be vague, for they may be made in Whitechapel for all I know) are extremely decorative little things, with a squat stability that suggests strength without ugliness. If you examine their detail, it is rarely, save in the very best examples of a high order of art, but they answer their purpose admirably, and know the important point "when to leave off." Yet inlaying with mother-of-pearl would probably be a more costly operation than buying the real thing outright.

To take a suitable design and paint it in set conventional Oriental patterns, with colours in the key those self-taught Eastern folk use so cunningly, would be better than the plan followed in the table hereby set forth. But colour is a hard thing to describe in words. My idea of blue and yours may differ as the sky at midday and Reckitt's advertisements. My notion of purple may be a sort of claret stain, yours the dazzling brilliancy of the aniline so-called violet. Yet I do not say that my notion of each colour is artistic and yours commercial, still less that there are "art colours" any more than art notes in music. Colour and notes are the common material of each artist, and if one makes a beautiful colour harmony, and the other a rare melody, while his rival creates only garish discords and vulgar comic songs, it is purely the merit or fault of the worker who spoils his material, not of the tints or sounds themselves.

Therefore, in lieu of inlay or colour, I have dared to modify the shape, and add some fretwork, of no style in particular, to give a decorative quality.

The necessity of compression (within one page of WORK) of full size working patterns has rendered it important to describe the whole rather fully and with frequent reference to the diagrams.

As this "oddment," to use a dealer's word for the endless variety of small tables and stools, is for the weaker brother to make, its very infantile joinery must be apologised for in advance. In the columns of WORK the correct way is pointed out by many capable leaders, and should any reader wish to make this table, and disdain every word of my suggestions for its fitting, so much the better. But if some unskilled workman would fain try his hand on such a thing, I think the course suggested will keep the structure together until some weighty visitor

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A Mauresque Coffee Table.

FULL-SIZE DRAWINGS FOR THE FRETWORK ORNAMENT AND PLAN OF THE CONSTRUCTION.

BY

E. BONNEY STEYNE.

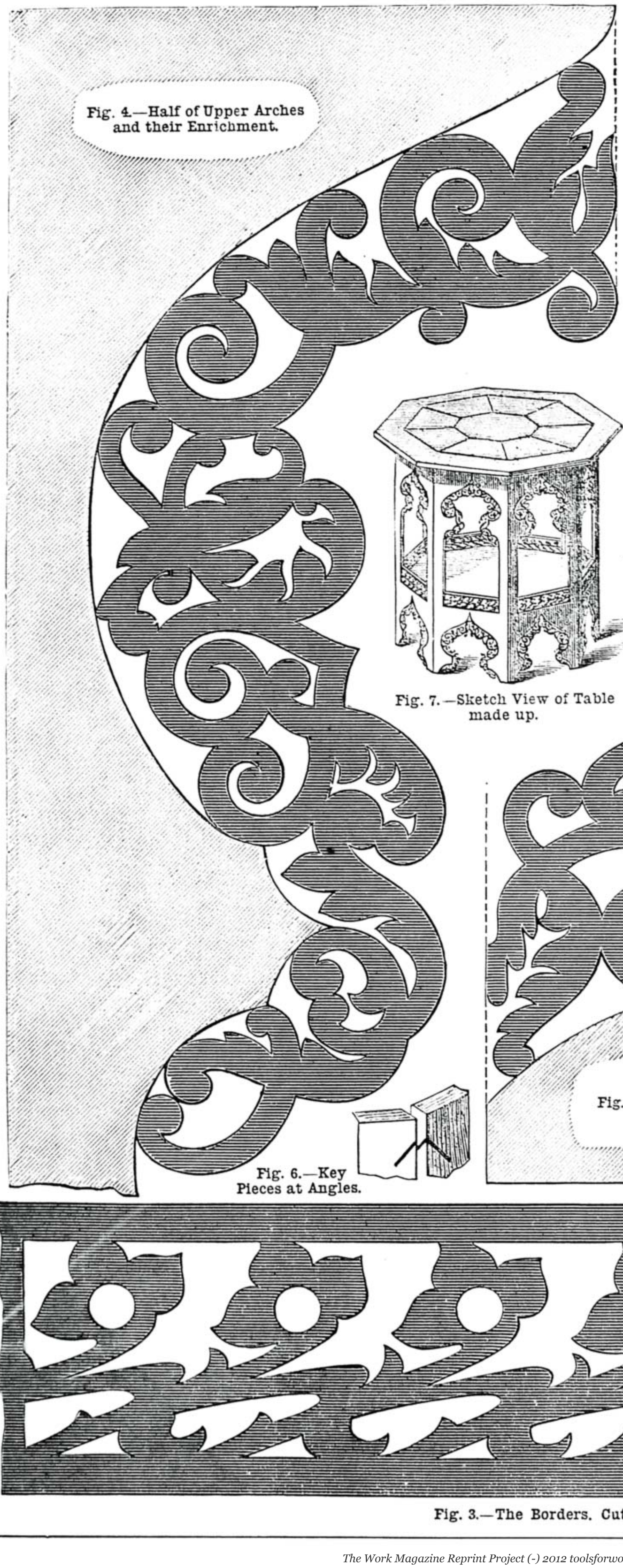

Fig. 4.—Half of Upper Arches and their Enrichment.

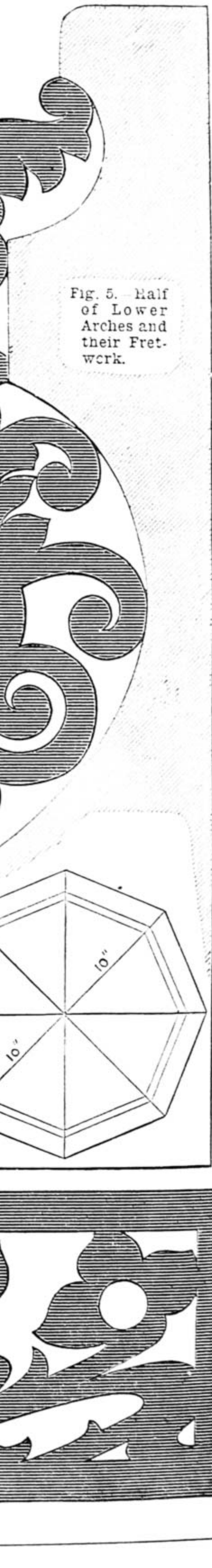

Fig. 5.—Half of Lower Arches and their Fretwork.

Fig. 7.—Sketch View of Table made up.

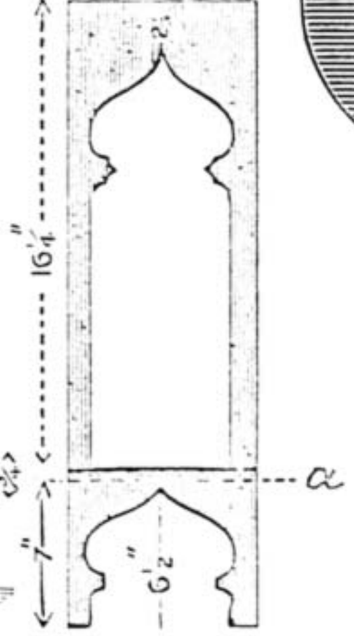

Fig. 1.—Plan of Uprights.

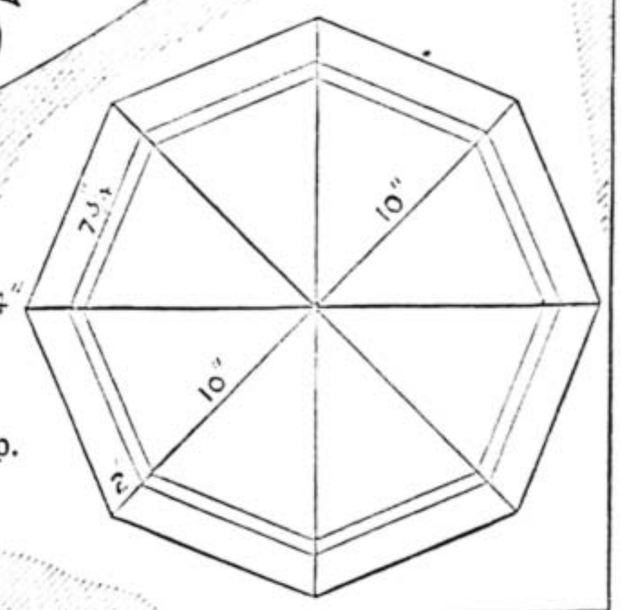

Fig. 2.—Plan of Table and Top.

Fig. 6.—Key Pieces at Angles.

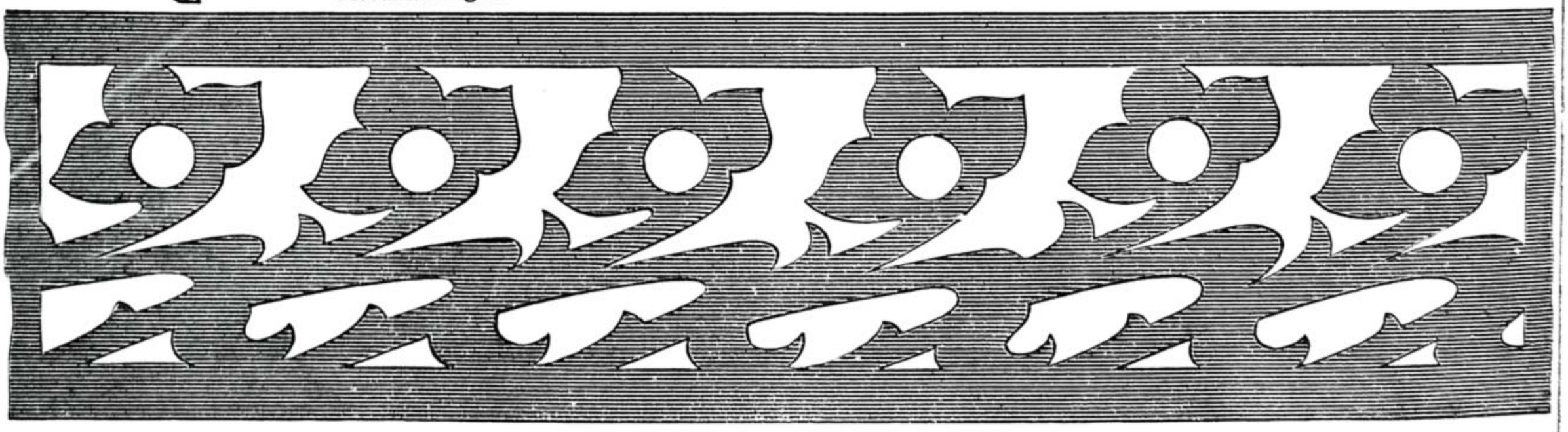

Fig. 3.—The Borders. Cut Eight.

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mistakes it for a seat. It is not guaranteed to carry hundredweights or tons, yet if fixed as indicated, will not be more nervous and quaking than I am at venturing to introduce such a bungling piece of joinery into the pages of a paper devoted to serious work.

To begin, take a piece of wood, or pieces, tongued and glued to the requisite width (19¼ inches); on it draw a perfect octagon. For those who have forgotten their Euclid, it will suffice to draw a series of lines in Union Jack fashion—that is, a cross bisected with another at the angle of 45° from the centre; mark each radiating line at 10 inches from the central point; connect these marks with straight lines, and the octagon, from which I propose to evolve the table, is ready to cut. Work two of these in inch stuff, taking care that they are geometrically accurate, and facsimiles of each other; then take eight pieces of deal (or other wood) 2 feet long by 8 inches wide; these may be of half-inch stuff; bevel the edges until they fit exactly round the two octagons, making, as it were, a box, not unlike a concertina (which is usually a hexagon, however), with the bottom placed at the point *a* of Fig. 1. Having fitted them, trace upon them the *outlines* of the two arches within the fretwork, at the distances indicated by diagram. With a keyhole saw cut these as there shown, and smooth the edges to a good finish. If you can rabbet the arches to let in the fretwork from the back, do so by all means, having, say, ¼ inch rabbet, and leaving on the fretwork a quarter of an inch to fit therein. The fretwork pieces in Fig. 4 are to be copied in full for the upper arches, and those in Fig. 5 which show pieces for the lower ones. The pieces Fig. 3 may also be provided for in the same way; they form a balustrade to the shelf, and hide the rough edge of the sawn straight line across the grain, which is difficult to finish neatly. Having worked the fretwork either with its ¼ inch border for the rabbet, or to the full size as drawn, as the case may be, if the fitting of the structure has been previously completed, the final fixing may be attained by screwing each piece to the octagonal shelf and top, gluing the bevelled edges, and securing them with key-pieces, put in at the angles, as in Fig. 6. Of course, it may be found, in spite of all care, that the table wobbles; if so the fault may be left until the last thing, when all is firm and set; then the feet must be shaved down until the table is both level and firm.

The top (Fig. 2) is an octagon of 24 inches from point to point. Whether this is plain wood with a bead, or with the balustrade Fig. 3 added; whether it is worked with a moulded edge or formed of eight isosceles triangles tongued together, with their grain parallel to the base of each, is just as the workman can or will have it.

The finish of the whole may be ebonised, "Aspinalled," or as you like it. If desired, the top may be painted with a design, the plain spandrels of the arches relieved with patterns, and so on. I think ebonised wood, with neatly painted conventional design in cream colour enamel, to simulate inlaid ivory, would be as little objectionable as any sham can be.

The stability of the structure would be increased by angle pieces or blocks, such as any actual table will show.

So with apology I offer the coffee table, which may, I hope, give pleasure to some, even if the purist and thorough person look askance at it, and condemn the wilfulness of the writer in venturing to offer such an unorthodox variety of what has hitherto borne an unimpeachable and blameless character.

HOW I MADE A VERTICAL CYLINDER.

BY ELECTRON.

A SHORT time since, I wanted a vertical engine cylinder of a certain size, and not being able to get a casting without making a set of patterns, I set about it in the following manner.

I got a piece of locomotive boiler tube about 3 inches longer than the length of cylinder. The tube was of brass $\frac{3}{16}$ inch thick; the inside was bored in an ordinary wood-turner's lathe, in the following manner:—A boring bar was fixed between the centres of the lathe, and the part at the outer or right-hand end of the cutter was turned true; two discs of wood were turned to fit into the end of tube with a central hole in them to fit the turned part of bar; the tube was then packed up with wood till at the right height, and two strips nailed on the top of packing, to keep the tube parallel to centres; the turned part of bar was then put through the two discs, one being at each end of tube; the tube was pushed forward by hand, the two discs and the packing keeping it parallel. As soon as sufficient length was bored for the cylinder, the tube was cut to the length, fixed on a mandrel, and the ends and outside turned up; each end was also reduced a little for ⅛ inch, as shown in Fig. 2.

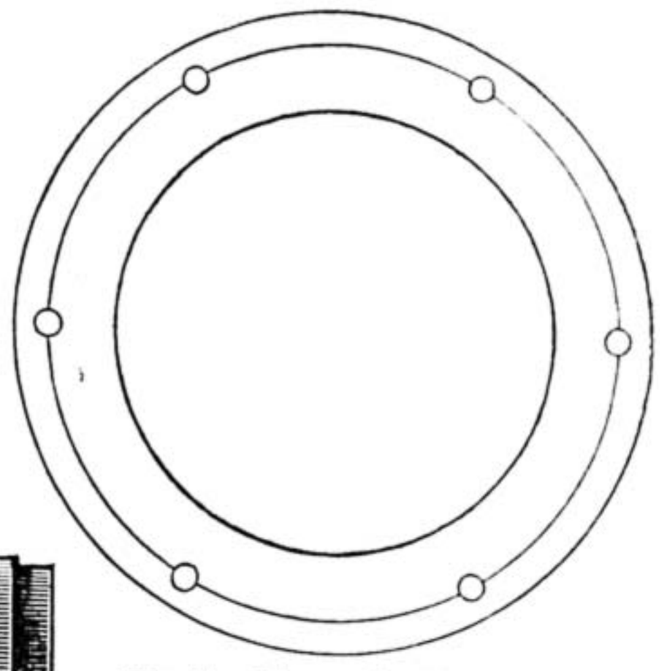

Fig. 1.—Flange for End of Tube.

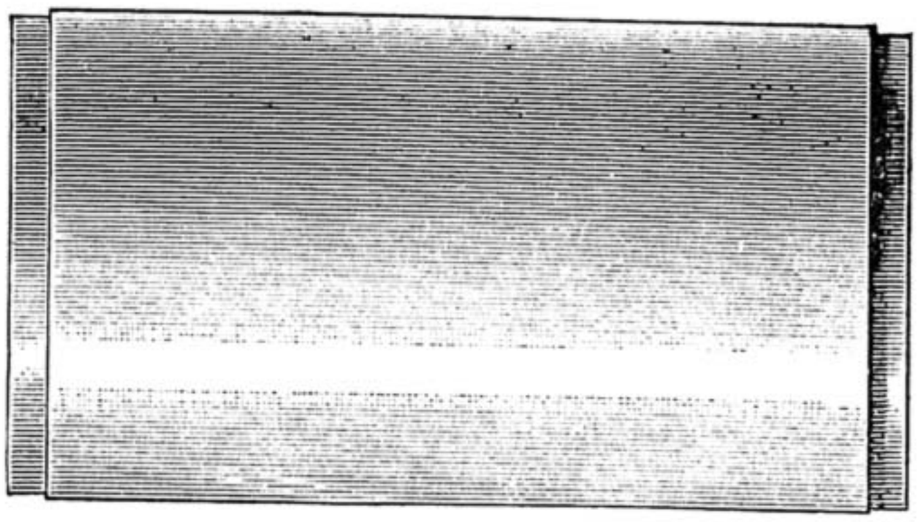

Fig. 2.—Tube for Cylinder.

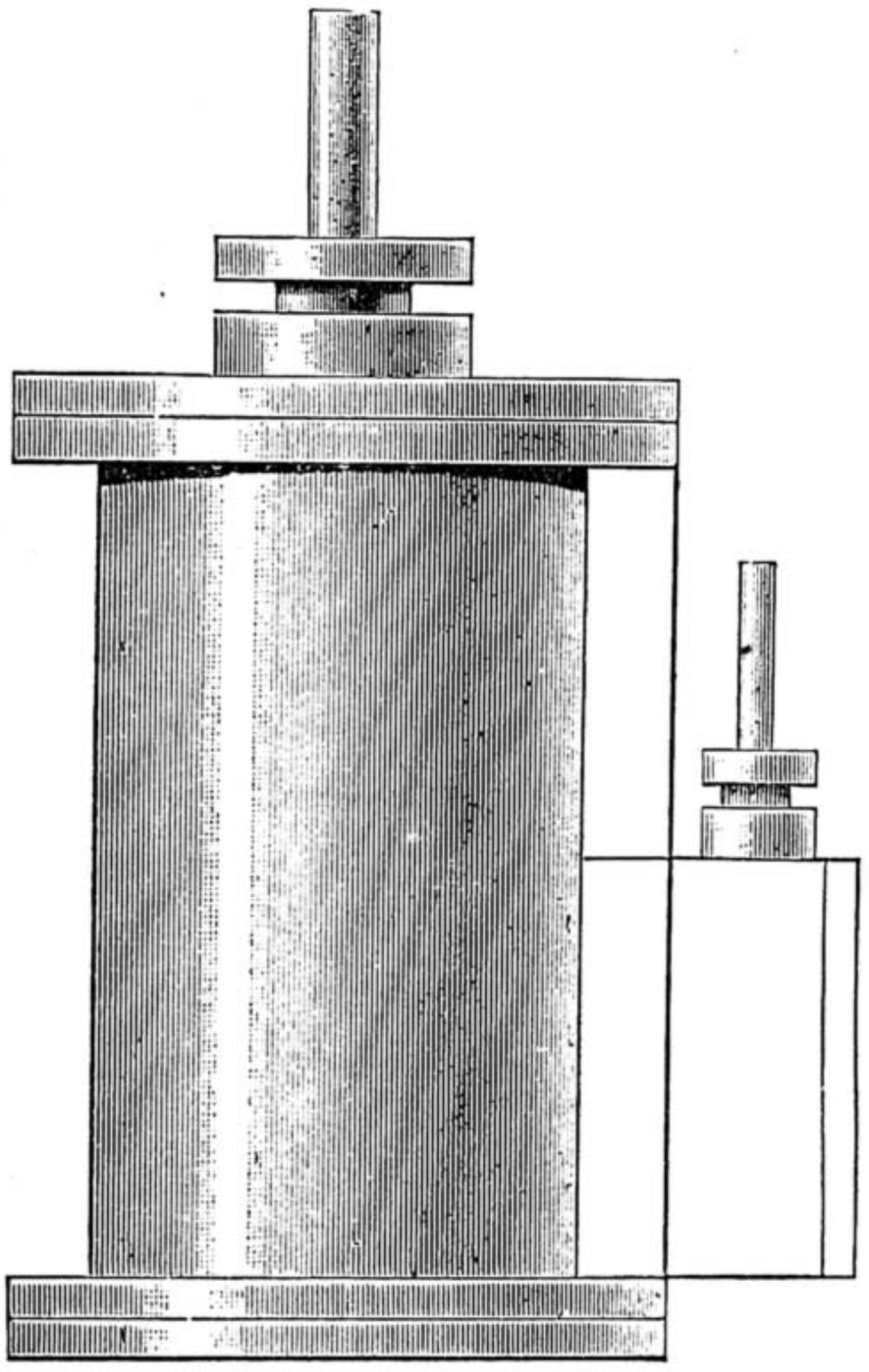

Fig. 3.—Completed Cylinder.

Two pieces of sheet brass ⅛ inch thick were fixed on face plate of lathe, and a piece cut out of the centre to fit the end of tube, and the outside cut off ¼ inch larger than the outside of tube. Fig. 1 shows one of these. The inside of the holes in these pieces and each end of tube were tinned by a soldering bit, and each piece was then soldered to the ends of tube to form the flanges, and turned up true.

The cylinder bottom was made from brass plate ⅛ inch thick, and was filed up square; in the centre of this a piece of plate, rather larger than the bore of cylinder, was soldered, then fixed on the face plate and turned to fit the bore of cylinder. Fig. 4 shows cylinder bottom.

The top cover was formed in a similar manner, except that it was circular, and had a piece of brass ⅜ inch thick soldered on the top side to form the stuffing box. This was turned and bored in the usual way; the gland was also formed in the same manner, a piece of ⅛ inch brass plate being soldered on a short rod of brass, turned to fit stuffing box, and bored for piston rod. Fig. 3 shows complete cylinder with top cover and gland.

The piston was also formed in the same way, three pieces of brass plate soldered together, and turned to fit cylinder, the centre plate being turned down to receive the packing.

The plates were soldered in the following manner:—Each piece

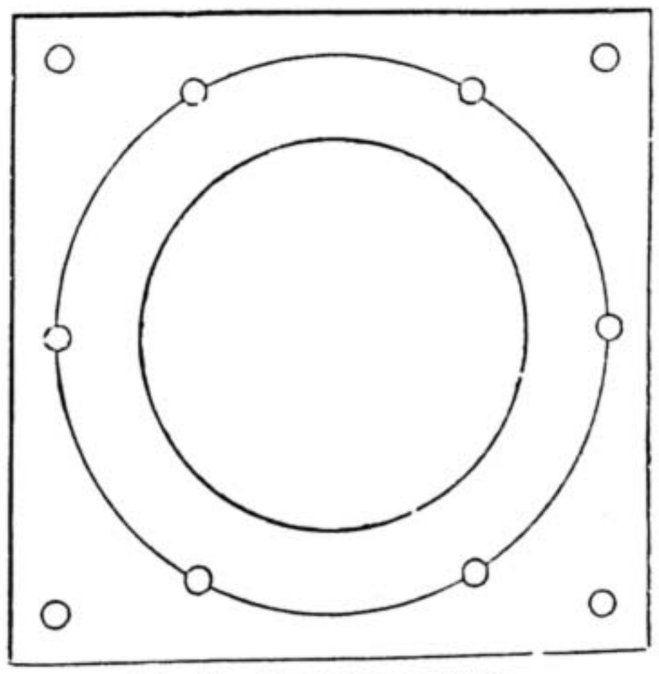

Fig. 4.—Cylinder Bottom.

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was tinned all over with the soldering bit; they were then put between two pieces of red-hot iron, and screwed up tight in the vice, and left till cool, when they were quite fast.

A piece of brass the size of steam chest, and ½ inch thick, was filed up and squared, and one side made hollow to fit on the outside of cylinder; the steam and exhaust ports were cut in it, and a hole drilled from one side into the exhaust port, and tapped for the exhaust pipe; a hole was also cut at the lower end of cylinder, corresponding to the steam port; this piece was then tinned on the hollow side, and the outside of cylinder being tinned, the two were sweated together.

A piece of brass about ½ inch square was filed up to form the top steam passage; a groove was cut in the underside of this; a hole was also cut from the top steam port, and into the top of cylinder; the piece of brass was then tinned on the underside and the ends, and the side of the cylinder being tinned, this piece was sweated into its place. The steam chest was cut out of a piece of solid brass ⅝ inch thick, holes were drilled round, and the centre cut out by a small chisel. A stuffing box was formed on the top, and a gland fitted to it; the cover for steam chest was made from a piece of brass plate. The steam chest had a hole drilled and tapped in one side for steam pipe; the cover and steam chest were fixed by four long screws.

The piston rod and valve rod were turned and fitted in the usual manner. The slide valve was made from a solid piece of brass, with a groove in the back, through which the valve rod passed, fixed by a nut at each end. The covers were each fixed by six set screws with canted heads.

The surplus solder at the edges of the joints was all scraped off, and the outside cleaned up with emery cloth.

BINDING SCREWS.

BY GEORGE EDWINSON BONNEY.

Binding Screws.—These are small clamps made of brass, and cast or turned in various forms to suit their requirements. They are used as convenient means of connecting one part of an electric circuit with the rest of the circuit. This has given to them the name of "connectors." When made in the form of a pillar or post and fixed by screwing or soldering to a base, they are named "binding posts." When fixed to the two wires proceeding from a generator of electricity so as to form the two poles of the generator, they are named "terminals." The accompanying illustrations will show at a glance several types of binding screws.

Fig. 1 shows a binding post as used for the terminal poles of dynamo machines. When used for this purpose the post should be massive, the threads on the screws well cut, and the hole for the wire left large. If these posts are nickel-plated, they enhance the appearance of the machine, and require less care to keep them clean. Some makers taper the post from the base upward, whilst others round off the tops. This is merely a matter of taste. The wires from the machine are twined around the tang of the post and secured by a nut beneath the base of the machine. Fig. 2 shows a ball pattern binding post used for a similar purpose. Figs. 3 and 4 show two "telegraph pattern" binding posts. These are used for the terminals of telegraph instruments. When made large, they are useful terminals for ammeters and similar instruments. Fig 6 shows a neat modification of the same terminal; and Fig. 7 shows a similar terminal furnished with a butterfly nut. This form of nut enables the workman to take a good grip on the wire connected to the terminal, and also to unscrew it without the aid of pliers. It is a form of nut that finds favour with French workmen, and is used by them instead of the milled head, so commonly met with in binding screws of English makers. Fig. 5 shows a simple nut and pin terminal, as used to insert in the lead tops of carbons

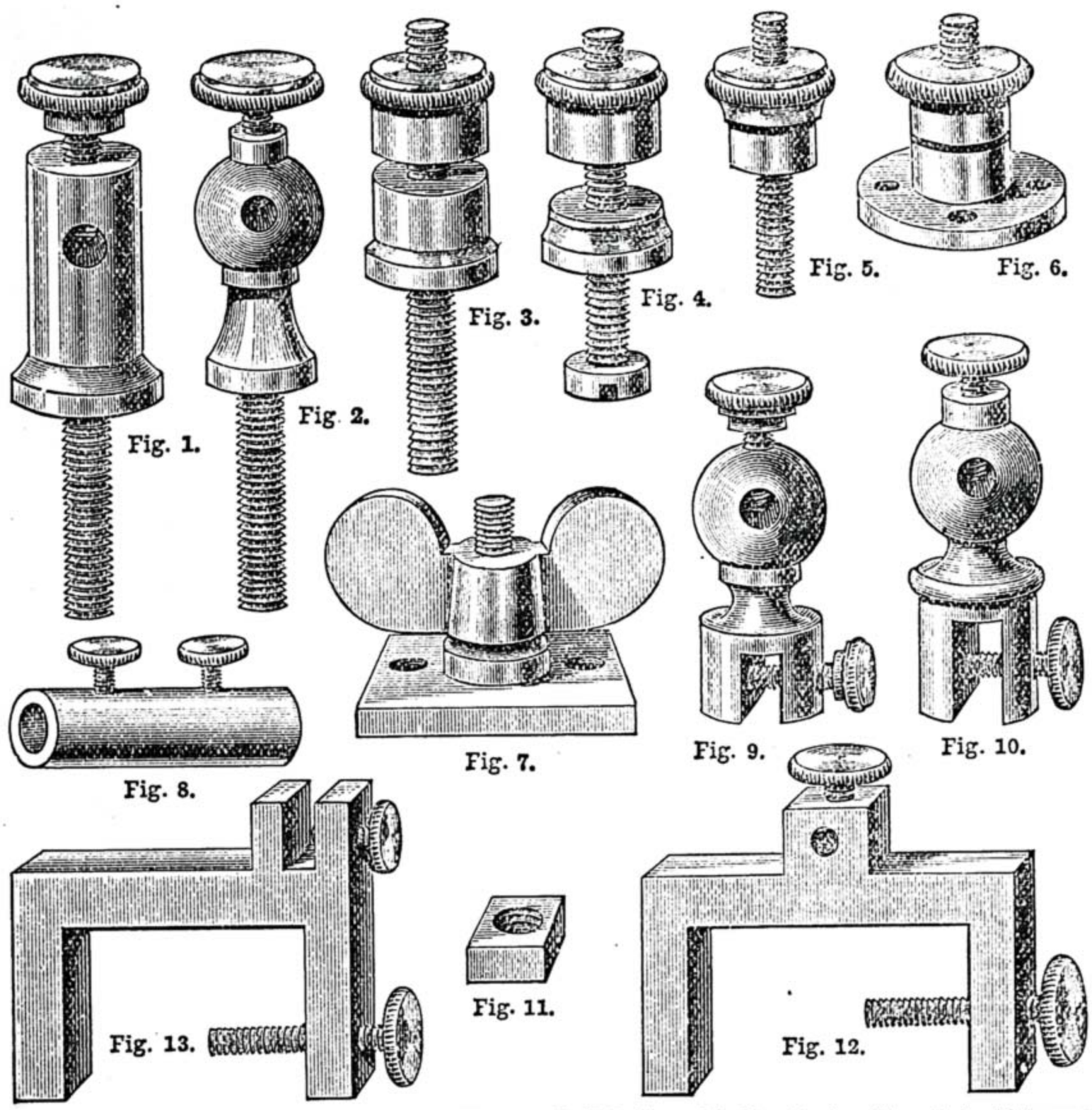

Fig. 1.—Straight Pattern Binding Post. Fig. 2.—Ball Pattern Binding Post. Figs. 3, 4.—Telegraph Pattern Binding Posts. Fig. 5.—Nut and Pin Terminal. Fig. 6.—Flat Base Terminal. Fig. 7.—Butterfly Nut Terminal. Fig. 8.—Wire Connector. Figs. 9, 10.—Binding Screws for Zinc. Fig. 11.—Binding Post Nut. Figs. 12, 13.—Clamps for Carbon Block.

employed in Leclanché batteries. Fig. 8 shows a wire connector made out of a piece of brass tube. Two holes are drilled and tapped in the side of the tube to receive two brass screws as shown in the sketch. These connectors are useful when we wish to connect a broken wire or connect two wires together. Thick brass tube should be used, or else a lug should be soldered to the side to thicken it where the holes have to be made, else the holes will not contain enough screw threads to allow of the screws being tightened on the wires. Figs. 9 and 10 show two forms of binding screws made and sold as clamps for connecting wires to zinc plates and cylinders. These patterns of binding screws are both faulty. The milled heads of the screws hurt the finger and thumb of the workman whilst unscrewing them from the battery. Both forms get weakened at the angle of the jaws by the action of the mercury from the zincs, and then one of the jaws breaks off. The threads on the screws are very fine, and soon wear out. Figs. 12 and 13 show two forms of clamps sold for connecting wires to the carbon blocks of the Bunsen battery. Fig. 12 is a well-formed clamp, but the milled heads of the screws are objectionable. Fig. 13 is only suited to cells connected by strips of copper, or by means of special wires flattened at one end and soldered to a copper strip. They are inconvenient forms of clamps for any purpose.

In No. 1 of WORK, page 4, I show two patterns of clamps made to my order by Messrs. H. Dale and Co. It will be seen that the jaws of the zinc clamp are massive and strong, and the angle of the jaw stands high above the zinc when the clamp is fastened to the plate or cylinder. The top screw passes through a long neck cut with several threads, and this gives it holding power. The threads are also coarser than those in general use, and flat thumb-screws have been substituted for milled heads. The carbon clamps are similarly well made and strong.

The binding screws and clamps of Bunsen cells often get very dirty, and the screw threads become corroded by fumes from the acid. To lessen the labour needed to keep these parts clean and in working condition, have them lacquered whilst new. As the lacquer gets damaged, make the brass warm and dip in melted paraffin; this will cover up bare spots and protect the threads of the screws from being corroded. It is also well to oil the threads of the screws whilst they are dry, before setting

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the cells up. Clean off all oil and paraffin from the parts to be in actual contact with the battery elements. Should the screws become corroded, soak them first in warm water to loosen the corrosion, then wipe this off with a piece of rag, but be chary of dipping them in acid to clean them, as this will cause the screws to work loose and lose their grip. If binding screws are cleaned and oiled before they are put away, they will always be ready for use and never set fast with corrosion.

Bottles.—Glass bottles stoppered with ground glass stoppers should be the only bottles used by the electro-plater for his acids and solutions. For large quantities of solution the acid-proof stoneware bottles made by Messrs. Doulton, of Lambeth Potteries, will give satisfaction, but common stoneware bottles are untrustworthy, for sooner or later the glazing gives way and the bottles leak. Smaller quantities of acids and solutions are best kept and handled in the tall half-gallon glass bottles known as Winchesters. Bottles holding from 20 to 40 fluid ounces, are handiest for daily use in the laboratory whilst testing and assaying. Strong ammonia, and carbon bisulphide, together with any other highly volatile liquids, should be kept in closely stoppered bottles, with the stoppers tied down. Hydrofluoric acid must be kept in gutta-percha bottles. Should a ground glass stopper become fixed in a bottle, some care and ingenuity must be brought into practice to effect its safe removal. First gently tap the sides of the top of the stopper with a small wooden mallet or the handle of a hammer, then grip the top in the jaws of a stout pair of iron tongs and try to wrench it around. Do not use sufficient force to twist off the neck of the bottle or the top of the stopper, but enough to start the stopper if slightly loosened by tapping. Should this treatment fail to move the stopper, next put a few drops of paraffin oil around it near the rim of the neck and allow this to penetrate the crevice between the stopper and neck. Then try another course of gentle tapping and wrenching. If still stubborn, get an assistant to hold the bottle whilst you twist a towel or piece of flannel around the neck, and work it to and fro rapidly for a few minutes; this will warm the neck by friction and cause the glass to expand. If this fails, the neck should be warmed with flannel soaked in hot water, or with a flame of a spirit lamp, when the glass of the neck will expand and leave the stopper loose. To prevent stoppers from becoming fixed, wipe them with an oily rag before inserting in the neck of the bottle; also wipe the inside of the neck to free it from salts, as these crystallise in the neck and frequently fix the stopper. Do not stopper warm liquids, but allow them to cool before stoppering, as these in cooling create a vacuum and draw the stopper fast. Do not mix sulphuric acid with water in a bottle, as the heat developed is likely to crack the glass. Always label each bottle as filled, and paint them with warm paraffin if intended to be set aside for some time.

Borax.—Sometimes named biborate of soda. This is a compound of boron, sodium, and oxygen, found as a natural salt in India. Its composition is represented by the chemical formula $Na_2 B_4 O_7 + 10H_2 O$. This salt is useful in the workshop and in the laboratory as a flux for brazing operations, a flux for smelting gold, and a vehicle for substances being analysed by the blowpipe. It may also be used as a case-hardening compound, with some success. It also forms an ingredient in mixtures used for colouring gold, and whitening silver. See notes on *Gold Colouring*, and *Silver Whitening*.

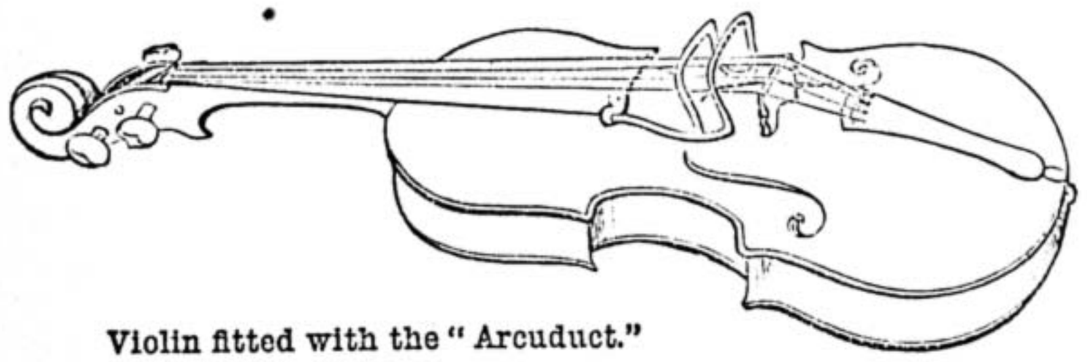
Boxwood.—The seasoned wood of the box tree forms a good substitute for such insulating substances as ebonite and insulite. It is used as insulating rings for the commutators of dynamo electric machines, collars for the insulated pillars of electric bells, and bobbin reels for these and other instruments. The dust from this wood, obtainable from wood engravers and boxwood block-makers, forms the best material for drying electro-plated articles, since it does not stain the pure silver deposit.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

94.—THE "ARCUDUCT."

THE "Arcuduct," or, in plainer English, the bow-guide, is a small but useful little instrument, devised and recently patented by Mr. Sydney J. Pope, Purewell, Christchurch, Hants. It is an appliance that is easily attached to the finger-board of violins and violoncellos, and has for its object the guiding of the bow in the proper position. It is claimed by Mr. Pope that it insures perfect bowing, and if it will accomplish this, it must manifestly be a great boon to all those who are learning and practising on the violin and any instrument of its class, whether small or large. The appliance itself is made of wire bent into the necessary form, and filled at the end with a small clamp, actuated by a screw with a milled head. By this clamp it is attached to the upper right-hand corner of the finger-board of the violin as shown in the accompanying illustration. Starting from the clamp, the wire is bent in such a manner as to form two arches about $\frac{5}{8}$ inch apart in the small size, which cross the strings just midway between the top of the finger-board and the bridge. I am told that in playing the violin, the bow should cross the strings in a direction at right angles to the strings themselves, and midway between the bridge and end of the finger-board. I do not play the violin myself—indeed, I do not play any instrument, though a stray correspondent will sometimes try to convict me of playing the fool,



Violin fitted with the "Arcuduct."

if nothing worse—so in this case, I have been obliged to seek information from those who do. Thus, according to what I have been told, the young violinist when compelled to keep the bow between the two arches of wire is obliged to draw it across the strings just in the right place, and thus is led to acquire a habit of bowing which is never forgotten. The "Arcuduct" may be had in brass or electro-plated. For terms, dealers and those who wish to buy them singly must make application to the patentee.

95.—A USEFUL BORING-BIT.

The accompanying illustrations show from three different points of view the form and construction of a very useful boring-bit which has long been in use in the United States of America, and which was first shown me by an amateur who had been travelling in the States, and had there purchased some of them. I then strongly

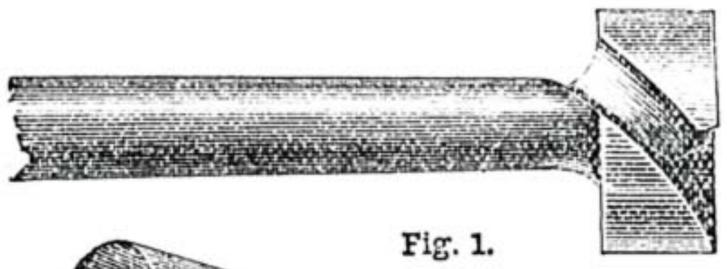


Fig. 1.

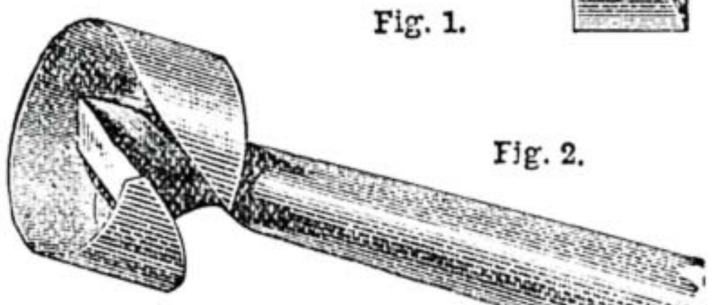


Fig. 2.

Fig. 3.

Fig. 1.—Boring-Bit, Elevation or Side View. Fig. 2.—View of ditto, showing Form of Interior. Fig. 3.—View of ditto seen as in Plan.

advocated its introduction into this country, but heard no more of until it was brought to me the other day by Mr. Melhuish, of the firm of Richard Melhuish & Sons, 85 and 87, Fetter Lane, London, E.C., and shown to me as a new tool. The nature of the bit will be sufficiently apparent from the illustrations, and it will suffice to say that it does the work of the centre-bit, but does it very much better, for the bottom of any hole that is bored by it is flat and without any mark whatever, while the bottom of a hole made with a centre-bit has in its centre a hole equal in length to the central projecting point of the bit. For this reason, the American boring-bit is especially useful for dowelling, etc. The bits have a long shank, and as they are constructed in a such a manner as to facilitate clearance, holes may be bored to a considerable depth with comparatively little labour. I have a piece of wood before me, in which all that can be done with the bit is shown in a thoroughly practical manner. For example, by boring in two directions at right angles to each other, a square hole may be made which requires but little clearance at the corners with a chisel to make it square at the bottom as well as at the sides. Diagonal holes can be bored with it very readily, and it can be used for boring conical indentations wider at the bottom than at the top by holding the bit in a slanting direction. By means of a series of bits ranging from $\frac{1}{16}$ in. upwards to $1\frac{3}{8}$ in., a set of depressions can be bored, descending by steps, as it were, from the widest to the narrowest diameter named. By moving the bit from point to point round the circumference of a circle, a circular groove of uniform depth may be easily cut. In short, a skilful workman may turn the bit to account in a variety of ways. I do not know the price or the number of bits comprised in a complete set, so readers who wish for information on these points must kindly write to Messrs. Melhuish & Sons, instead of to me. I will, however, when I am myself acquainted with these points, name them in "Shop."

I have no hesitation in recommending this recent introduction from the States as a most useful and desirable addition to the varieties of bits that are used with the brace.

THE EDITOR.

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SHOP:

A Corner for Those who Want to Talk It.

*** Notice to Correspondents.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Home-made Planes.—E. P. W. (*Warrington*) writes:—"The first thing I look at when I get Work is 'Shop,' and on page 300 I see a moulder approves of my plan. It was a moulder that suggested it to me many years since, and I found it worked well. Some time I will describe a plane that I made myself that will answer for both smoothing plane and rabbet plane, and how to make the pattern, if you think well of it. I know wherever I have worked all hands have used it, and I have had a good price offered for it many a time."—[By all means send me a paper on your plane on approval.—Ed.]

Papers in Work.—D. C. (*Huddersfield*) writes:—"I was very pleased to see my letter appear in a recent number of Work. I was afraid you had thrown it into the waste-paper basket, as it is a few weeks since I wrote to you. I may say I am still looking for the promised article I mentioned in my previous letter, and hope it will not be long before it appears. I may tell you that I have just finished a pattern for an iron smoothing plane, which appeared in Work some few weeks since. I am anxious to have a casting made from it, but do not know how to get it made. I am very much interested in the letters by E. P. W., 'Pattern of Plane for Casting,' and 'Home-made Planes,' by Bert, also the papers by the author of 'Home-made Tools.' I have been thinking it would be a great advantage to many of the readers of Work, who are trying to carry out the instructions of the author of 'Home-made Tools,' if you would try and prevail on Bert to write a few plain instructions telling us how to mould castings for home-made planes. I see, according to his letter, he is a practical man, having made dozens himself. I should also like to repeat the query of G. T. M. (*Liverpool*), with reference to instructions how to make small furnace for melting iron or steel. Also will A. H. (*Wolverhampton*) give us a fuller description of his fan or machine for current of air? I should prefer the fan being of iron or brass, and the sides and top of iron, with detailed instructions how to make the machine complete."—[I daresay Mr. Milnes, lathe and tool maker, of Bradford, would make a casting for you from your pattern if you write to him. I shall be happy to have papers on approval on the subjects named in your letter from the correspondents specified therein, if they will write them and send them to me.—Ed.]

Building Construction.—C. S. (*Newcastle-on-Tyne*) writes:—"Referring to the letters of W. P. and A. E. D. in No. 13 concerning building construction, is it your wish that the various readers of Work who take an interest in the subject should supply plans of various houses to be published in Work, or do you intend, in the course of time, to give a series of articles upon it? If you wish to have plans forwarded by your readers, I would try and do my best to help, as I take an interest in the subject, although I have never before sent to any paper."—[I shall be glad to see any plans you may desire to send.—Ed.]

Overmantel, with Cupboards.—Clerk (*Leytonstone*) writes:—"When I saw and bought the first number of Work, I was not entirely a beginner at woodwork, as I had been through two courses of lessons in carpentry at Toynbee Hall, each course consisting of making various joints, under the instruction of a master, during an hour and a half once a week for three months. In addition to this practice, I had made some Oxford frames out of the top of an old deal table, had knocked up a chicken house with old packing cases, and various other jobs of the same sort, together with a few fretwork frames. But Mr. Adamson's design for an overmantel fired my ambition, and I made up my mind that, at any rate, I would try and make it. Last night I finished it after working for about a couple of hours nearly every evening for the last three months. The wood I used was common ¾ in. floor boarding, together with yellow deal ¾ in. thick. I took the liberty of altering the design slightly, and instead of making cupboards I put panels covered with Lincrusta Walton at the back, and the open spaces under the side shelves are also filled in in the same way. In the centre, instead of a shelf across the middle, I have inserted an old-fashioned-looking glass, with a wide rosewood frame, which has been in our family for the last century and a half. This is let into rebates, cut in the two middle uprights for the purpose. The woodwork is finished off with two coats of Stephens' satin wood stain, and varnished. The Lincrusta is enamelled sea-green to match the wall paper of the room. Now that it is done, it looks fairly decent, and I don't think any ordinary observer would know that it was done by a nineteen-year-old clerk in his spare time, the total cost (exclusive of the Lincrusta, which was given me) being 6s. 2d. I should like my next job to be an umbrella stand. Could you see your way to giving me a design for one in your valuable columns? The main point with me is that it should be cheap, made of wood, and with as few tools as possible, as I have such a small collection of these. I hope that Work may continue to be as useful to every one as it has been to me; if so, I am sure its circulation will be enormous."—[Yes; you shall have an umbrella stand as soon as I can find room for it.—Ed.]

Swords.—J. C. K. (*Paris*) writes:—"In my article 'Swords' some errors got into print. Page 291, line 25 from bottom of first column, should be 'heating.' Second column, line 32 from bottom, should be 'elliptic.' Page 292, line 34, should be 'play,' not 'plug'; line 63, 'slings,' not 'strings.'"

Swords and Work.—W. E. M. (*Pall Mall*) writes:—"I was pleased with a paper in No. 19, and that was about swords. I showed the article to my master, and he showed it to some more of the workmen, and it has caused three more numbers to be taken in every week. They were so pleased with it; it was the first time they had Work, and they say it is worth recommending to all classes of workmen. For my part, I am satisfied with it, and wish it every success, for I have never before seen such a good specimen of the help-one-another as our little corner 'Shop.'"

Useful Scroll Saw.—Artist in Wood writes:—"I send you a sketch of a useful scroll saw for cutting wood from ¾ in. to 1½ in. thick. Fig. 1 shows side view, and Fig. 3 front view of fittings. Fig. 2 shows shape of irons to receive slides. The slides should not fit tight, fly wheel to run as shown by arrow. The stroke of saw is 4 in. The saw will be found to come forward to the work at the down stroke. It is very easy to work, and will cut wood of the thickness named very quick. Use a saw ⅝ in. wide, ground thin at the back. This saw has been in use fifteen years for trade work."

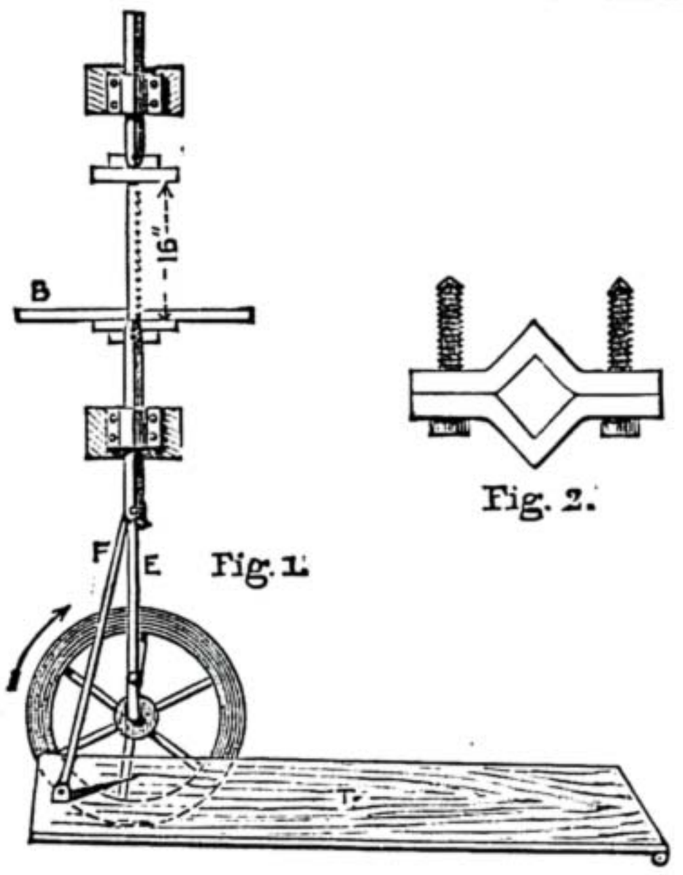

Fig. 1.

Fig. 2.

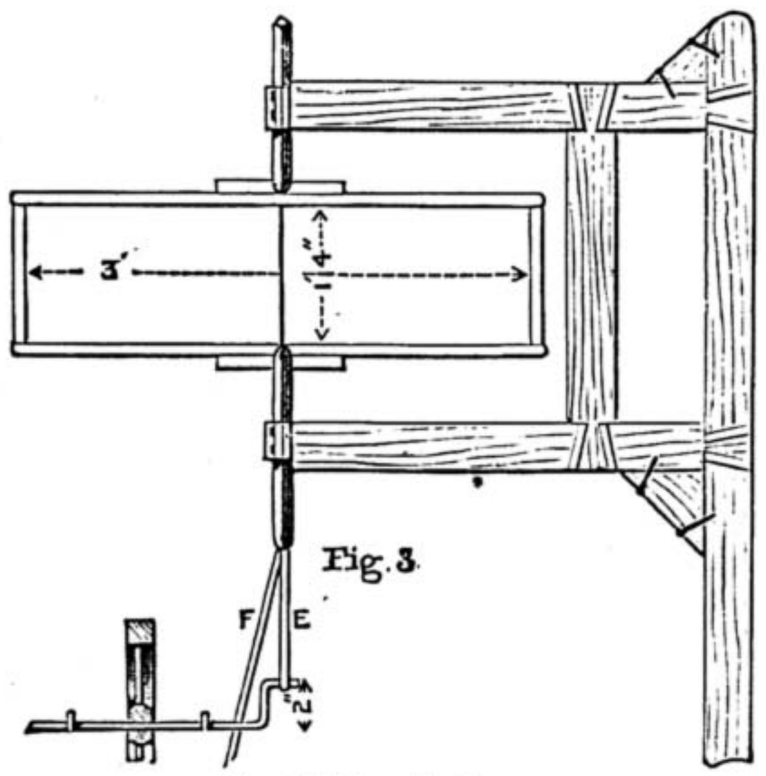

Fig. 3.

Useful Scroll Saw.

B, Table; F, Rod to fit end of Slide and Treadle; E, Rod to fit end of Slide and Crank; T, Treadle Board.

Moore's Patent Folding Chair.—Mr. J. T. Moore (*Langley, Macclesfield*) writes:—"I note that you have an illustration in No. 23 of Work of a chair, No. 3, that is patented for this country. You are no doubt aware that by the Patent Law of 1883 to make a copy of a patented article, although for personal use, is an infringement, and is actionable at law. Kindly draw attention to the above facts in your next. I am quite sure that your excellent paper will not knowingly encourage injustice in any form."—[Certainly not. Work will never lend itself knowingly to the countenance of anything that is wrong, and therefore I publish your letter with the utmost pleasure. Mr. Lebrun, I am sure, was as ignorant as I was that the form of chair to which you allude was patented in this country, but, you see, none of us can know everything, and hence its appearance. The illustration was derived from an American source. Kindly note that I shall be happy to notice in "Our Guide to Good Things" any speciality you may have or produce, whether patented or otherwise.—Ed.]

Æolian Harp.—G. L. G. writes:—"A detailed description how to make an æolian harp would be an appropriate subject for Work, and welcome to many a subscriber this winter, including myself."—[Will any competent reader oblige?—Ed.]

II.—Questions Answered by Editor and Staff.

Steel Distorting.—G. H. (*St. Helens*).—The reason the steel gets distorted in hardening is, I think, because you make it too hot, and, in dropping it in the oil or water, you let it get horizontal. Just get it a dull red and drop it carefully in perpendicular or endways. I seldom distort anything by going to work this way.—A. B. C.

Wood Pulp.—E. A. (*Liverpool*).—Wood fibre is, we believe, prepared in this country, for the use of paper-makers and others, by crushing withy poles between heavy rollers. Papier-mâché articles made from it in the ordinary way with glue paste would necessarily swell if exposed to wet, but a substance impervious to moisture might be formed by mixing with boiled oil, or some similar medium. As regards procuring pulp, and for further information, E. A. is referred to Messrs. McCallum and Hodson, Summer Row, Birmingham.—S. W.

Silvering Worn Harness Mounts.—B. (*Balsoon, Navan*).—Unless you care to go to the trouble of re-electro-plating your harness mounts, the best thing you can do is to get some silvering solution, and apply to them. I expect you will be able to purchase it at any silversmith's or ironmonger's; if not, here is a recipe:—Nitrate of silver, fifty grains; potassium cyanide, four grains; liquor potash, fifty drops; water, half-ounce (by measure). Mix and bottle. N.B.—This is poison. Apply with a piece of flannel, and use a little plate powder. Polish with chamois leather.—R. A.

Zinc Clock Dial.—Decorator (*London*).—The dials of small circular American times and alarms are printed on paper, and then pasted to the zinc, but the larger American clock dials are, I think, hand-painted. The second query, as to designs on glass doors of clocks, I cannot answer, but I rather think they must be transfers, and then painted over at the back to fix them.—A. B. C.

Photo Camera.—D. M. (*Inverness*).—The size of camera must depend on that of the plate to be exposed. As you will have seen in the article on pin-hole photography to which you refer, the image being always in focus, the length of extension is comparatively unimportant. The further the plate from the hole the larger the image, with indistinctness slightly increasing. Any needle will do. Of course it is only the point that is used, as the hole must be small. Any of the ordinary dry plates, films, etc., may be used. In fact, the only difference in the process consists in having no lens.—L. J. P.

Soldering Aluminium.—G. F. B. (*Dalston*).—(1) On receipt of your letter, I communicated with the secretary of the Aluminium Company, Limited, 115, Cannon Street, E.C. In his reply he says, "The soldering of pure aluminium is a difficulty, and no certain method of doing it is now generally known." The metal has been soldered by Mr. Watts, of 8, Carnaby Street, Regent Street, W., and the soldered articles are exhibited by Messrs. Percy Edwards and Co., 71, Piccadilly, W. Mr. Watts keeps his process of soldering a secret. I *collected* for Rouge Buff all the information obtainable on the subject, and, therefore, gave a guarded reply. I have not soldered the metal myself. (2) The ingredients composing the solder must be melted by fire. I find it best to melt aluminium first, using common salt as a flux, and then add the other metals of the alloy. Granulate and re-melt two or three times. (3) By solid paraffin is meant the pure paraffin wax used by electricians for insulating purposes.—G. E. B.

Electro-gilding in Colours.—Aqua Regia (*York*).—To electro-gild in colours you must have a separate bath for each separate colour, and keep it specially for this purpose. To gild *green*, add silver-plating solution to the gilding solution in very small quantities at a time until the required tint has been obtained; too much silver solution will cause a whitish deposit, known as *white* gold. To gild *red*, add a solution of copper cyanide, or use a copper anode until the desired colour is deposited. To gild *rose pink*; first gild the article and scratch-brush it, then deposit a mere flash of silver on the surface; on this deposit a mere tint of copper from an alkaline copper bath, and then just a blush of gold to tint the copper. The process is a delicate one. To oxidise brass, paint it with a solution of chloride of platinum. To oxidise silver, paint the parts with a fresh solution of ten grains sulphide of potassium dissolved in a wine-glassful of hot water. Apply with a camel-hair brush.—G. E. B.

Electricity from the Earth.—Miller (*Leeds*).—It is quite true that an electric current can be obtained from two plates of dissimilar metals sunk in the earth, such as zinc and copper or zinc and carbon (represented in the case you quote by coke).

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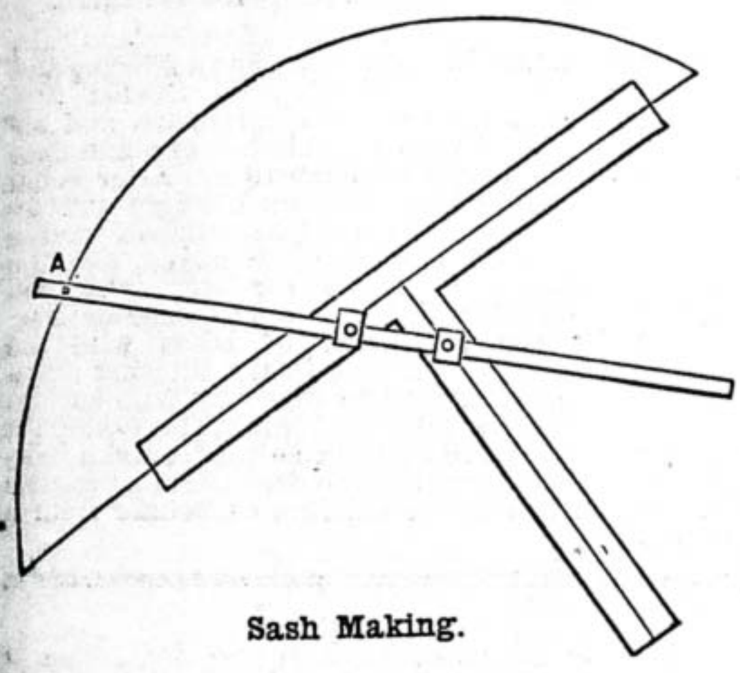
I have obtained a current from the gas-pipes and the water-pipes of a house, and a friend of mine has actually done electro-gilding with such a current by way of experiment. At the time you speak of (1844), great things were expected of this discovery (?), but its usefulness is limited by the low pressure of the force thus obtained.—G. E. B.

Sash Making.—JOINER (*Dalston*).—Instructions in sash making would take up more space than could be afforded in a brief reply in "Shop," but a paper dealing with the subject will shortly appear, in which the intricacies of setting out, and the various joints that puzzle the novice, will be clearly shown. The tool you inquire about for drawing ovals is usually called "trammels;" you can buy it



Sash Making.

at a tool shop, but it is usually a home-made thing, and consists of a long piece of wood about ½ in. square, on which are two brass slides with studs on the underside. These studs work in grooves cut in a T-square, and the size of the oval is regulated by the distances from the end of the rod and between the studs. The annexed figure will help to show you how the apparatus works. A hole is bored at A for the insertion of a lead pencil.—G. LE B.

Electro-Plating.—MANKTELOW (*Winchett Hill, Kent*).—Plating can be learned by the most inexperienced person, if he will only faithfully follow the directions of his teacher. Amateur plating (such as silvering and gilding alberts, bracelets, brooches, etc., or even spoons and forks) may be easily learnt, and I hope to give some easily understood lessons on this subject in a future number of WORK. If you will take the trouble to read the article on *Anode* in "Notes for Electro-platers," page 123, I think you will fully understand this term; whilst in the first three numbers of WORK you will find illustrated articles on Bunsen cells.—G. E. B.

Accumulator Plates.—D. S. (*Holloway*).—(1) The composition of accumulator plates is lead, coated with red lead, or with lead peroxide. (2) You may make them by the following directions, but you will see that the process is tedious. Procure lead plates of the requisite size, and let the thickness of the lead correspond with the superficial area of the plates, to prevent undue buckling. In cutting each plate, leave a lug 2 in. by 1 in. on the top to form connecting pieces. Perforate each plate with ½ in. holes all over. Make a paste of finely-ground red lead with oil of vitriol, and rub this with a lead or pewter spatula all over the plates until each hole has been closely filled and the plates coated with a crust of the paste. Connect the plates in pairs, one on each side of a strip of teak or mahogany (well soaked in hot melted paraffin), by means of short brass screws. See that the screws are not long enough to go through the strips and touch the opposite plate of lead. The plates are now to be placed in their cells (a pair of plates in each cell) to be formed, that is, to be charged and discharged again and again with a strong current of electricity from a dynamo until all the red lead (lead oxide) has been converted into lead peroxide. The cells should be of glass, acid proof stone-ware, or a similar acid proof and insulating substance, and should be charged to near the top of the exposed plates with a solution of one part sulphuric acid to twelve parts of water. Each pair of plates must now be included in an electric circuit, either with a dynamo or a very large battery, if the plates of the accumulator have a large area. If the voltage of the generator (dynamo or battery) is high, several pairs of the plates may be connected in series; but if the current has an E. M. F. of, say, three volts, only one pair of plates may be charged at a time. The E. M. F. of a pair of accumulator plates being two volts when fully charged, we must employ a generator having a higher E. M. F. than the sum total of the plates in series to be charged with it, or the accumulator will discharge itself back through the battery or dynamo, to the injury of either. Charge the plates for half an hour at first, then connect them up to some work, and let them discharge themselves; again charge for a longer period, and again discharge them. Continue this until the plates are formed, that is, until each square foot of positive plate will yield six ampères of current. (3) I should advise you to consult a practical electrician, and abide by his advice respecting the size of accumulators required for your installation, and the other matters connected therewith. (4) If you get the plates from the E. P. S. Co., they will advise you respecting installation, or you may get both plates and advice from Mr. H. Dale, 26, Ludgate Hill, E.C. (5) I must leave this matter to be decided by our Editor. I cannot give professional advice by private letter without a prepaid fee, the amount of which would depend on the work to be done.—G. E. B.

Article for Iron Moulders.—D. J. J. (*Birmingham*).—There is no place in Birmingham, or anywhere else, where you can get your invention registered on credit. The stamp for protection for nine months costs £1. The necessary forms are supplied free at the Chief Post Office, but you must pay for the stamp.—F. C.

Prospectuses of WORK.—E. L. R. (*Oxford*).—These were forwarded to you on receipt of your request for them, and should have reached you long ago. I take the opportunity to thank you for your good opinion of WORK, and your intention "to take it in as long as it continues." That I trust will be beyond my time and yours, too.

Cutting through Paper Tubes.—D. B. (*Glasgow*).—In the papier-mâché trade the approved method of cutting up paper tubing is in the lathe with a keen knife-like chisel, and it is easy to understand how the neatest cuts are to be made in this manner. But paper soon blunts the tool, and thick tubing is frequently merely nicked in the lathe, and then sawn. In default of a lathe, we do not see how D. B. can cut his tubes better than with a fine tenon saw.—S. W.

Covers for WORK.—J. H. (*Wolverhampton*).—The pasteboard covers were suggested as temporary means to keep the numbers clean until binding time comes. Your wish is that the advertisements could be relegated to covers, on the plea that as the numbers are now constituted the advertisement pages must, of necessity, be bound up with them. Well, why not bind up the advertisement pages? In course of time they will prove most useful to the readers of WORK as a record of "What to buy, and where to buy it." Everything, it is said, comes useful once in seven years, but I feel sure that the advertisement pages in WORK, after a time, will prove useful to many, perhaps, once in seven days, if not much oftener.

Book on Paints.—SUBSCRIBER (*Sunderland*) writes:—"Can you inform me of any manuals of technology or any work of chemistry, or colour striking? Also can you tell me where to get 'Trade Secrets,' and the price of the book?"—A work which might suit you is, "Painting and Paint Materials: a book of facts for those who deal in paint materials" (10s. 6d.), Spon & Co., 125, Strand, London.

French Polish.—C. H. W. (*Hastings*).—I am under the impression, from what you now say about not being able to mix the ingredients, that your question was answered in due course for the "Shop" columns. Owing to the length of time which must necessarily elapse between going to press and publication, it is impossible that answers can appear immediately. In case you have not discovered the cause of your want of success, and presuming your inquiry is the one referred to above, I can only advise you not to use so much polish, or to substitute for it methylated spirits. If you had told me exactly how you have mixed the things, I might have been able to discover the cause of your failure; as it is, I cannot do more than I have. The receipt is well known among French polishers, and is always effective.—D. A.

Imitation of Leaded Windows.—SPECTATOR (*Skipton*).—We presume from SPECTATOR'S note that the imitation of leaded lights required is that known as "Patent Glacier." The makers of this are Messrs. M'Caw, Stevenson, & Orr, Belfast. The agents for its sale in Great Britain are Messrs. Perry & Co., Holborn Viaduct, London, who supply a book of designs, with sample, instructions, etc., by post for 1s. It can, doubtless, be procured through any fancy shop.—M. M.

Dressing Skins.—SEALSKIN (*Liverpool*).—To prepare his roughly dressed sealskins for rugs, we do not see that our correspondent can do better than damp them (by rolling in damp cloths), stretch them tightly, and rub down the flesh side, till even and uniform, with pumice stone and powdered chalk. Lumps of flesh or fat will best be removed with a knife. The chalk will clean the hide by combining with and taking up its grease and dirt. Any skin can be made soft and pliant by thoroughly working oil or yolk of egg into its pores. By the last substance the beautiful softness of kid gloves is produced, the skins for making which—like our correspondent's sealskins—have first been roughly cured with alum. After egging, it is usual to draw the skin backwards and forwards across a blunt semi-circular knife fixed upright; this operation is called "staking." In the language of the workmen, "Staking brings the skins to themselves again," *i.e.*, it makes them appear as pliant as when first stripped from the animal.—M. M.

Horsehair Cleaning.—R. J. P. (*Feltham*).—The hair in question is, of course, for use as stuffing in upholstery work. If it is new hair, boiling with a little washing soda will effectually clean it, and remove all smell; and drying afterwards in an oven will tend to make it curl up, which is desirable. If it is old stuffing which has been curled, boiling is not recommended, as it would take out the curl, and so render the hair less elastic. To curl horsehair properly needs appliances which an amateur will not possess. In this latter case, the better plan will be to beat out the dust thoroughly with a pliant stick; to shake the hair in a sieve or riddle, to remove short fragments, foreign matters, etc.; to sprinkle it from a watering-can with dilute Condy's Fluid (this, if done with care, will not destroy the curl); and to dry it, which will best be done in an oven just *not* hot enough to singe it, as this will make sure of destroying any germs of disease or insect life which may have escaped the disinfectant.—M. M.

Tenant's Greenhouse Cost.—A. P. (*Heaton Chapel*).—The cost of material for making the "tenant's greenhouse" will vary according to the locality, as wood is dearer in most inland towns than in places near to a seaport; but I should say that the timber necessary could be bought for, say, £8 to £10. If you want to be economical, use white pine, which is the cheapest, although not so easy or pleasant to work as yellow; and for the sole framing you might procure an old beam at a builder's yard for a few shillings that would suit your purpose quite as well as new wood.—G. LE B.

Carving in Cast Iron.—PIPER (*Manchester*).—I am not quite sure that I understand your meaning. You ask "How to carve in cast iron, etc., such as these sweets we see, fish, raspberry, dolls." Do you mean cast iron moulds or dies? If so, these would not be carved, but cast from a plaster or clay model, and chased up afterwards.—J.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Bicycle Repairs Tools.—ANIMO ET FIDE:—"As a practical repairer of cycles, my experience is that there is almost no end to the tools that may be bought for this work, as a great many are to be had that are more ornamental than useful. As to the tools that seem to me absolutely indispensable for cycle repairing as a pursuit, I will mention them as shortly as possible. The lathe and slide rest are all right to begin with, if the heads are not less than 4 in. About the best chuck is a Cushman two-jaw, fitted to the lathe mandrel. This chuck will take in objects from about 2 in. down to ¼ in., and is splendid for holding the larger-sized drills. N.B.—I never use any other than twist drills, except for boring out spoke stumps; for drills under ¼ in. shank down to No. 14 B.W.G. (Birmingham wire gauge) the 'Essex' drill chuck, price 10s. (Britannia Co.), is A 1. It is held by the 'Cushman' in the lathe, and with these you can drill almost anything. A leg vice of, say, 4½ in. jaws, fixed to a firmly fitted-up vice board, you must have, also a good hand vice of, say, 1½ in. jaws, to hold small articles for filing, etc. A strong pair of cutting pliers; an assortment of files; a taper reamer of square section. A ratchet drill stock is indispensable to drill out old spoke stumps. Then as to screwing tackle. A die stock and set of taps, say, from ¾ in. down to ¼ in., and a screw plate with taps from ¼ in. down to, say, 18 B.W.G., are necessary. The spoke grip is about the first tool taken in hand, and the last to finish the repair of a wheel with. It costs from 1s. 6d. to 2s. When you get a wheel to repair with butted spokes, a difficulty comes in that does not exist with the direct spoke. A head has got to be worked on the spoke after it has been passed through the rim of the wheel. To head the spoke in these circumstances, a somewhat ponderous spoke-heading machine is used. I make use of a simple substitute which does the work very well. It is shown in the annexed cut (Fig. 1). A A are two plates of steel 4 in. by 2 in. by

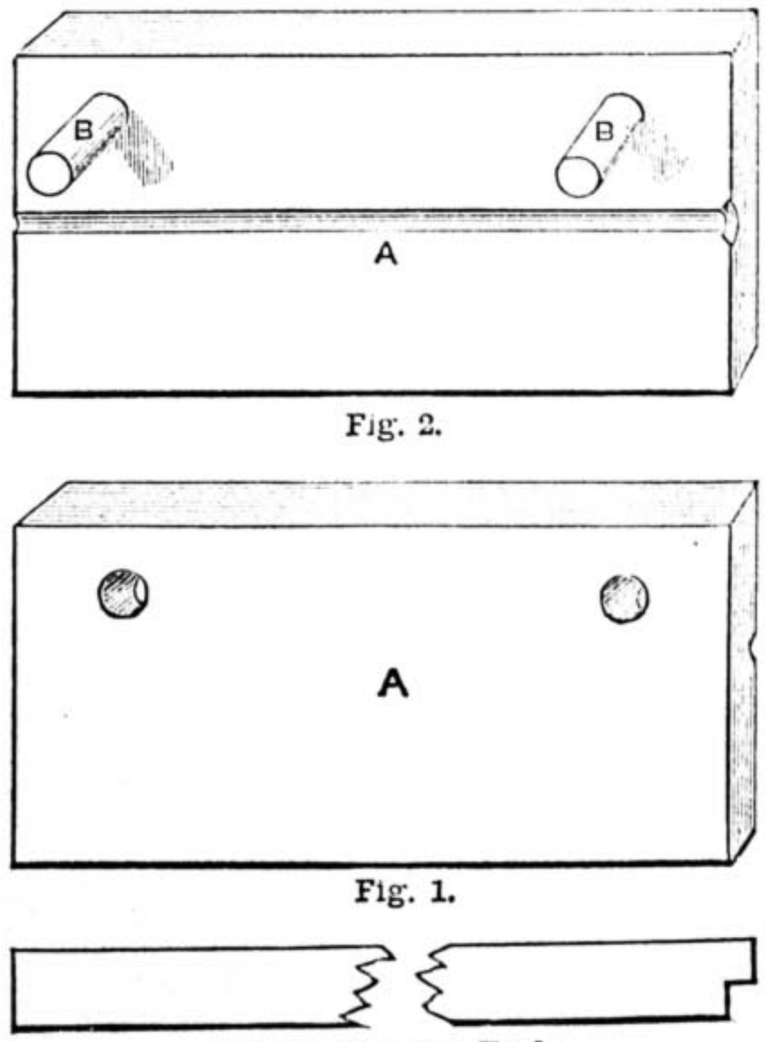


Fig. 2.

Fig. 1.

Bicycle Repairs Tools.

½ in. on the upper edges, and $\frac{1}{16}$ in. less on the under edges; in one of the plates are firmly fixed two steel pins, B B, ¾ in. thick; they fit to slide into two holes in the other plate. Along the centre of both

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plates is cut a groove, either circular or V-shaped, and somewhat less than the half-section of the spoke. The two plates being placed together, the right-hand end is countersunk to the size of a spoke head. To use this tool the spoke is placed in the groove with the end protruding about $\frac{1}{16}$ in., and the plates fixed firmly in the vice. The head is now staved up cold with a hammer. In the case of butted spokes the wheel is placed in front of bench board, with the rim near the vice, and the spoke having been previously screwed home in the hub and cut to length at the rim, allowing $\frac{1}{16}$ in. to make the head, it is screwed from the hub, pulled through the rim to the vice, when the 'heading block,' just described, being put in vice with the spike, as mentioned, in it, the head is made with ease. The spoke is again screwed into the hub with the grip before mentioned. This heading block I made from two pieces of a heavy file softened to bore in the fire. If your correspondent means to go the length of brazing, he will require a forge with a fan blower or blowpipe. I use a fan blower fitted to a small forge, and it does very well for brazing, the forge being necessary for all kinds of light forgings, tempering drills, heating tyres, cementing rubbers, etc., etc. In fact, it cannot be done without. A grindstone is another necessity. A small one to run in the lathe might serve all purposes, grinding drills and slide rut tools, etc. Now, as to a buckled wheel. If the wheel is badly buckled, the chances are that the rim is cracked at the edges, in which case it had better be put aside altogether, and a new one put on. If the rim is whole, but very much twisted, the best way is to loosen all the spokes with the grip, then see how far the rim has come back to its proper position. If there are still any sharp side bends, place the rim on a block of wood, and hammer the bends straight with a wooden mallet; then proceed to screw up the spokes: some of them may be overhauled—*i.e.*, pulled out of the hub by accident, and the thread spoiled. Where this is the case the hub should be rescrewed with a tap a size larger, in order to work a fresh screw, and a new spoke, a size thicker, screwed to fit. The wheel is now adjusted by screwing in the spokes all round to the depth they were at first. The rubber being removed from the rim, a lath of wood may be used. This lath is as long as to reach from the hub over the rim. A notch is cut on one end of the lath (see Fig. 2); this notch is placed against the hub between the spokes, and a mark is made on the lath at the outer edge of the rim. A truly trained wheel has the outer edge of the rim equidistant from the hub all round, and that on both sides. The lath will at once show which spokes to screw up and which to bring back in order to achieve this result. I have frequently made wheels to run true by simply countersinking the rim every hole the same depth, cutting all the spokes exactly the same length, and screwing them all exactly the same number of threads, and, on putting up the wheel, screwing every spoke exactly the same depth into the hub. Such a wheel will as likely as not run dead true at once, without further adjustment. A buckled wheel is more difficult to put right than building a new one. Sometimes the spokes will not stand the strain necessary to pull the bends out of the rim; hence the necessity of hammering as before mentioned. When your wheel coincides with a mark on the lath at the rim all round, and when applied on both sides, then the hub will be found to project equally from the centre plane of the wheel. Now place the wheel on the axle, and allow it to revolve freely; then holding a piece of chalk steadily, let the parts that may be out of truth touch the chalk for two or three revolutions: do this on both sides. Then at the chalk marks, if the spokes feel tight, loosen them a little, or if the spokes on the opposite side of the chalk feel loose, tighten them up; clean off the chalk, turn the wheel again, and rechalk, repeating the adjustment of the spokes as before; continue this until the last vestige of wobble disappears. The spokes should all now give forth the same sound when twanged like the strings of a harp. There are several firms that send out materials in small parcels: Lloyd & Co., Warman Street, Birmingham; H. Matthews, Snow Hill, Birmingham; Wm. Bown, about the best place to get good things in bearings, etc., 308, Sumner Lane, Birmingham; Thos. Smith & Son, Saltley, Birmingham; Brown Bros., 7, Great Eastern Street, London, E.C. There are several others, but your correspondent would get well served with any of the above, and all of them send out price lists. I shall be happy to give any further information I can on the above subject to ANIMO ET FIDE, or others, by favour of our Editor."—A. S. P.

Broom and Brush Making.—ELECTRICITY (*Camberwell*) writes in reply to T. M. (*Rochdale*) (see page 253):—"I notice the above-named correspondent has a desire to make brushes for his own use. That being the case, I will volunteer (with your kind permission) to add further to the explanation already given respecting this particular handicraft. T. M. must bear in mind that if large quantities of brushes were wanted it would almost be compulsory to have a lathe and brushmaker's bits to bore the holes in the stock (or wooden part of the brush). But for a very limited quantity for household use, and without going to the expense of fitting up a brushmaker's shop, I should say the holes might be made by means of the brace and bit. The holes must be made very clear and placed at a regular distance from each other, but not too wide apart. When advanced so far T. M. must have prepared a hot pan of pitch (but not boiling), which can be kept in a liquid state by means of oil lamp or burning charcoal; then proceed with the stuff (already cut up to a certain length), and knock one end up level in the left hand, and with the right hand pinch off just enough stuff to exactly fill the hole in the stock. Have previously prepared a quantity of hemp (shoemaker's hemp), cut into lengths of about 5 or 6 inches. So when the bunch (or knot) of fibre is dipped into the pitch it must be tied round quickly and tightly with the hemp close to the level end of the stuff, say, within $\frac{1}{2}$ in. When that is so far prepared it must be dipped a second time into the pitch, then into the hole firmly to the bottom, each one in succession, until the broom is completed; trim off the uneven stuff with a pair of shears, then the broom will be finished. Having said so much, it must be understood that the theory of brush making, like everything else, requires practice before any good results can be shown. But still, nothing attempted, nothing done."

Drilling Square Holes.—A. C. O. (*London, E.C.*) writes in reply to A READER (see page 270):—"I notice in No. 17 of WORK, in your questions submitted to correspondents, is the following. A reader states that he noticed in a paper that the scientific method of drilling square holes has been found out and patented in Austro-Hungary. I beg to inform him this method has been discovered in England by Mr. Ainley, and patented (No. 8,688) some months since, in the names of Ainley & Oakes. This machine will shortly be offered to the public."

Refrigerator.—C. F. W. (*Hampstead*) writes in reply to URGENT (see page 174):—"I herewith enclose rough plans of refrigerator counter. I think it possesses one feature not met with in any other—viz., the ice drawers. My former communication gives details of manufacture. Description of plans: Fig. 1, cross section—A, ice drawer; B, cupboard; E, inside door, zinc lined; D, outer door that

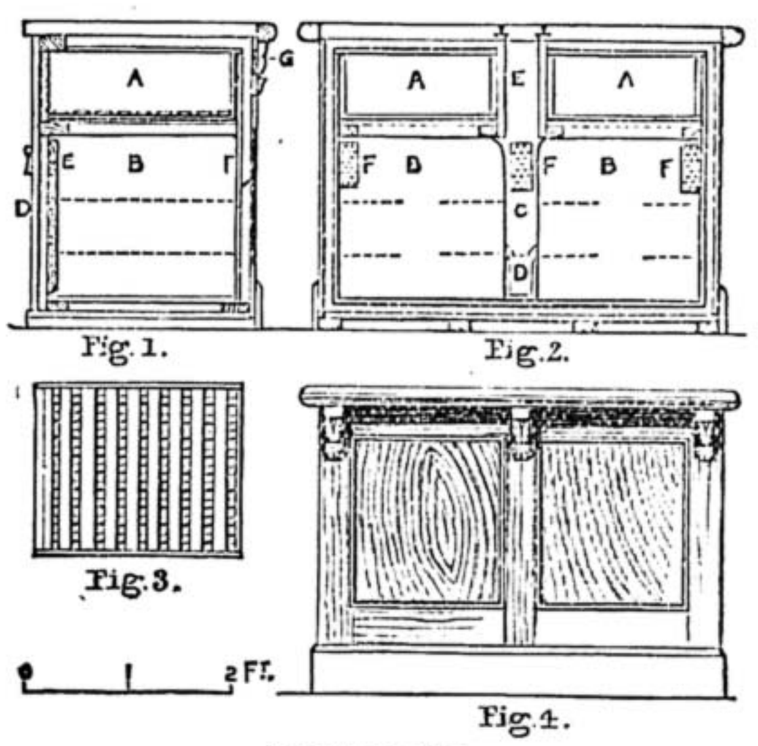

Fig. 1. Fig. 2. Fig. 3. Fig. 4.

Refrigerator.

shuts in ice drawer; F, perforated zinc ventilation that opens into shaft, having opening at top under truss, G. Fig. 2, length—A, ice drawers; B, cupboards; C, space between, formed with zinc lining. The ice water trickles down this from ice drawers into receptacle, D, where it may pass through bottom, or be drawn off with tap. E, space for water tank. Fig. 3, bottom of ice drawers formed with laths crossed $\frac{1}{2}$ in. apart. Fig. 4, front elevation with bead and flush panels."

Oxyhydrogen Blowpipe.—H. B. S. (*Liverpool*) writes in reply to T. W. B. (*Barnsley*) (see page 174):—"If you have not yet tried your oxyhydrogen blowpipe, I should advise you not to do so, as, if you use it, you will sooner or later have an explosion. The hydrogen and oxygen should not mix until they reach the nozzle. Besides, you do not require any reservoir like that figured. I give you a sketch of an oxyhydrogen blowpipe that I think will suit you. It is similar to those made by Fletcher, of Warrington. It would be best made in brass, and is intended to hold in the hand, for soldering lead sheet, brazing, etc. The blowpipes on stand are similar to the following:—

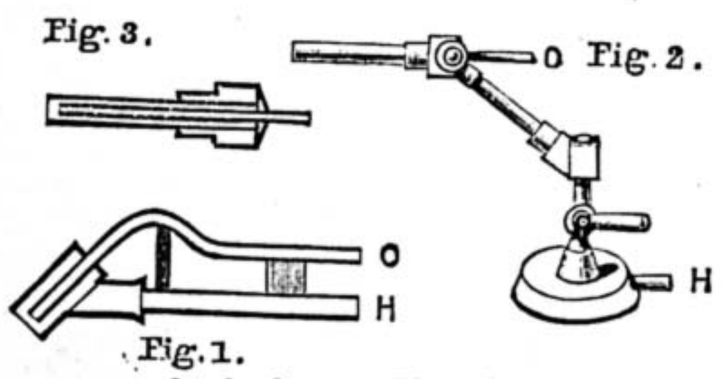

Fig. 3. Fig. 2. Fig. 1.

Oxyhydrogen Blowpipe.

Enlargement of nozzle. O, tube for oxygen; H, tube for hydrogen. In each case you will require a reservoir of each gas, so as to keep up a steady supply.

Trade Notes and Memoranda.

THE *Moniteur Industriel* gives an account of the invention of a glass pen, which is furnished with a helicoid groove to carry the ink.

THE soda engine is gaining in favour in situations where steam is not allowed, or cannot be used. It is employed in the St. Gothard tunnel. The boiler in this engine is filled with a few tons of soda, and when a jet of steam is introduced it produces an intense heat, which gives the motive power. When the soda becomes saturated, the action ceases. A jet of superheated steam from a stationary boiler is then driven through the soda; this drives out the mixture, and the soda is ready for use again.

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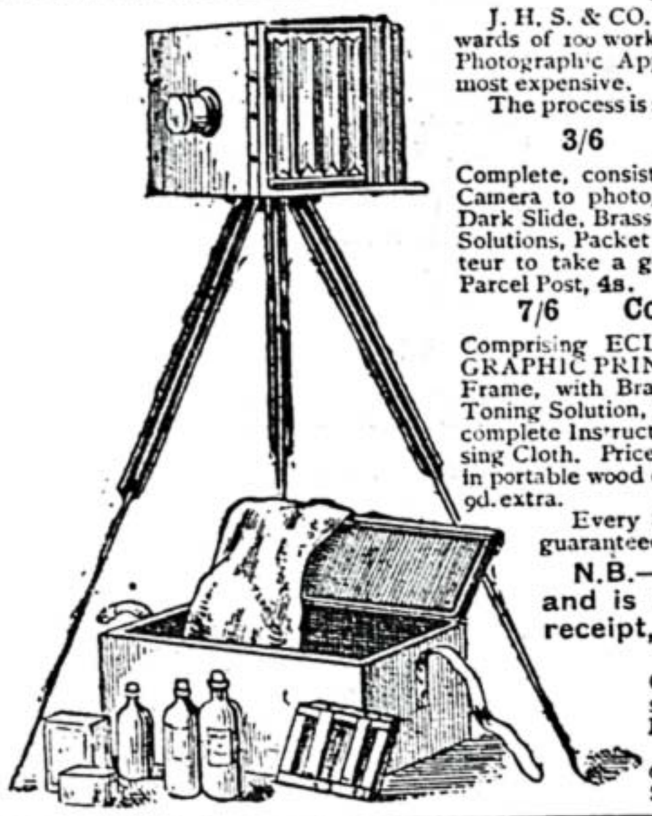

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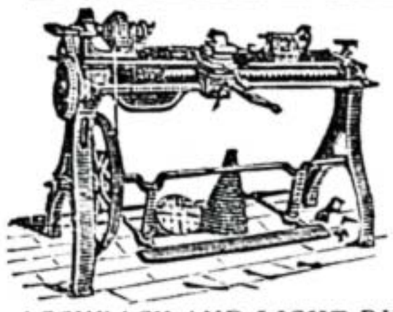

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